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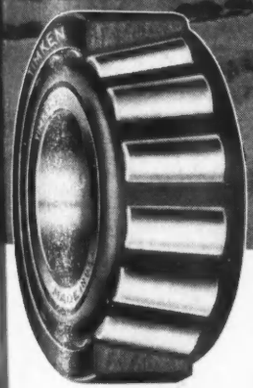

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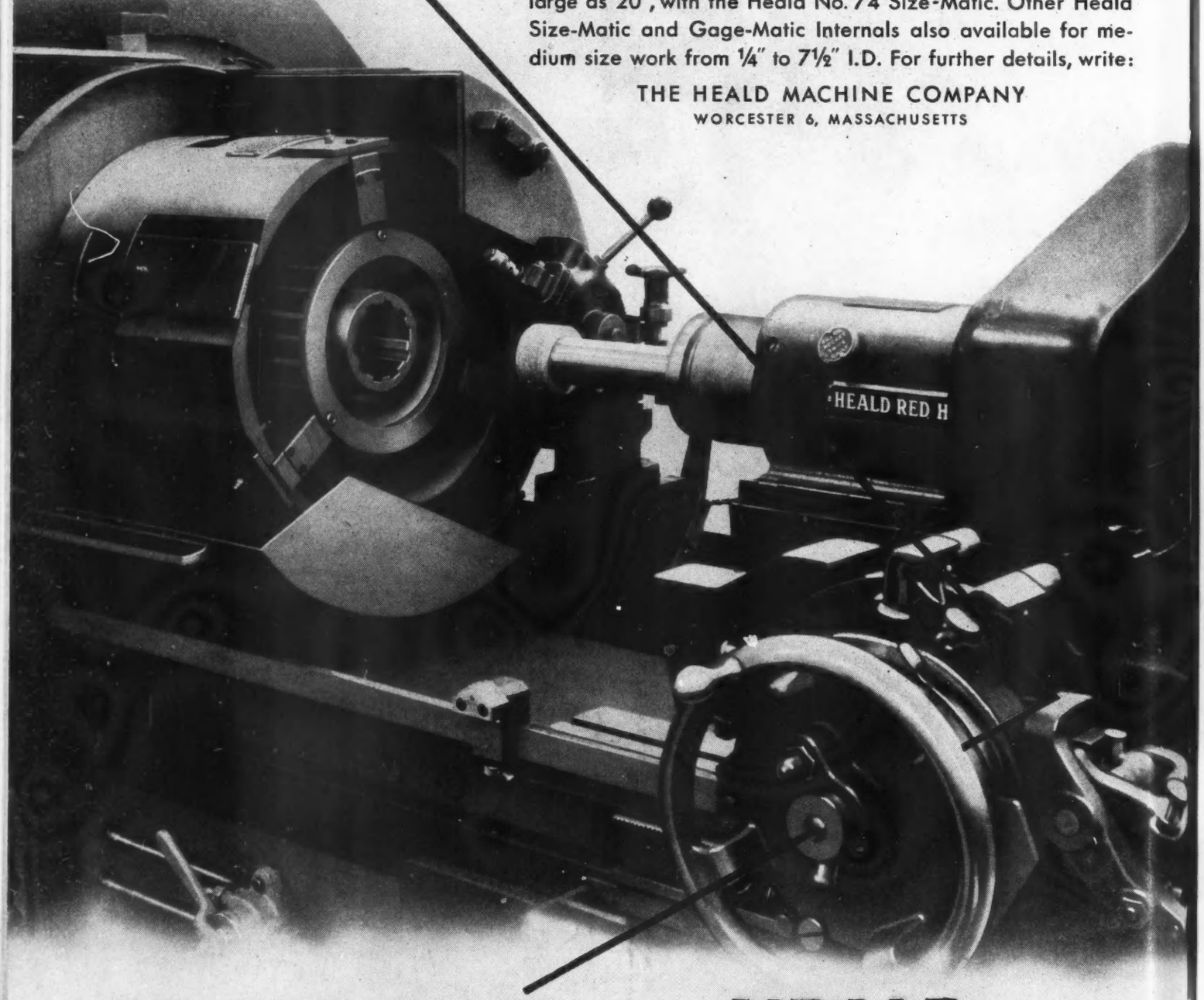

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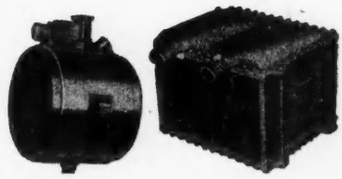

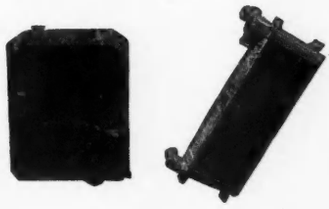

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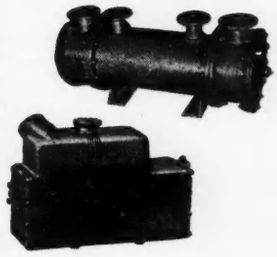

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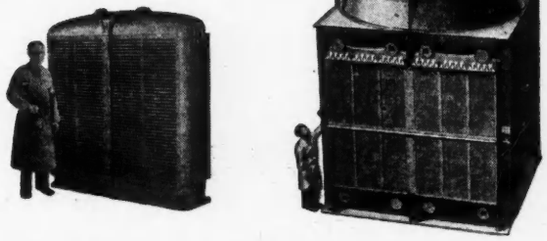

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Wages, Prices and Profits

"UNDER our American system, competition keeps prices low and thus distributes the benefits of increased industrial efficiency to the whole population. Under this system, customers' purchases determine the volume of sales and hence the production and employment in each of the millions of business establishments throughout the country.

"As part of this system, we have developed the idea of non-discrimination in price. Everyone who rides on a railroad train pays the same fare for the same distance and class of service; all pay the same price for a loaf of bread in the same store; all pay the same price for the same make of automobile and the same price for gas and tires, regardless of income.

"In our free American economic system which is an essential part of a free political system, obviously the most efficient producers will make the largest profits and the most competent individuals will earn the highest wages. A producer buys materials at market price and offers workmen wages sufficient to recruit a good working force. These represent the market value of the materials and labor. The producer furnishes the tools for the workmen. The better those tools, the more work that can be done without extra effort. When the producer supplies good tools and properly organizes and directs the business, his profits will be good. He will then be able to give the public a better product for less money and get more customers. This will encourage him to expand his business and create more good jobs.

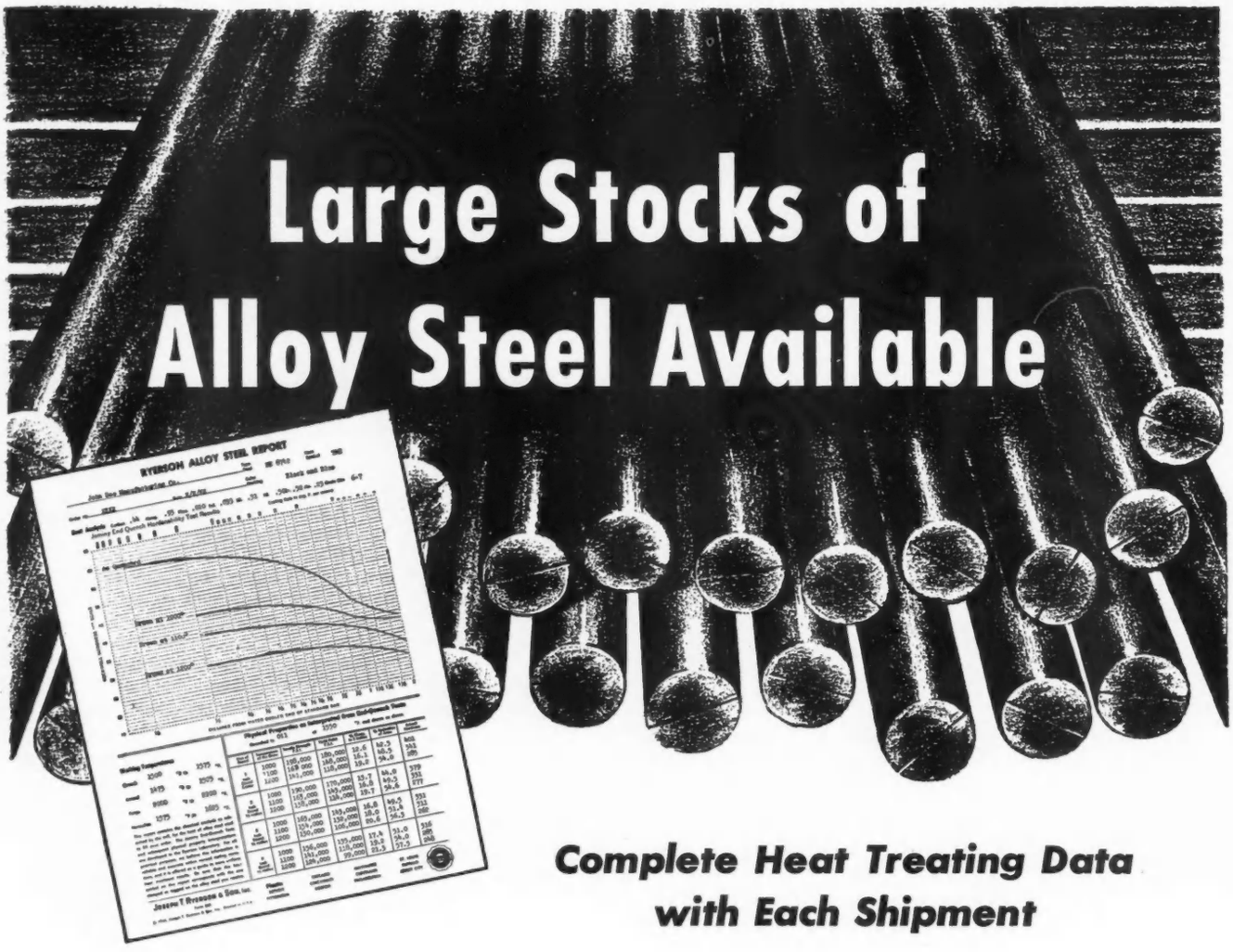
"Only to the degree that increasing technological efficiency serves to reduce costs can there be any gain to the economy as a whole. The benefit to the greatest number, which must be the prime objective of industry and which means advancing living standards to the maximum, occurs when technological efficiency is reflected in lower selling prices so that all can buy more. Hence more can be produced. That objective cannot be accomplished by confining the benefits of technological progress to those in the industries in which technological progress occurs.

"*Unless the more efficient businesses can make good profits there will be no incentive to increase the efficiency of their operations or to expand them and create new jobs.* When a business grows by serving the public in competition with others, while paying competitive prices for materials and high wages as compared to what people can generally get for their labor, whatever profits it makes are reasonable. Profits made this way represent a net gain in value to the country, because they are newly created values that did not exist before."

* * * * *

When the men of General Motors held that "ability to pay" is not an economic factor in wage determination and accordingly withdrew from the "fact-finding"

(*Turn to page* 48, *please*)



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RYERSON STEEL

Materials and Plant Reconversion Still Major Problems

By

Leonard

Westrate

AS THIS is written, with labor trouble stealing all the thunder and limelight in the automobile industry, there is a general impression that if strikes could be settled, automobile production would zoom to dizzy heights almost overnight. While there is no denying that industrial peace is a prime requisite to volume production of cars and trucks, it is not the only one. Almost obscured by the more spectacular news of strikes, the supply of materials still is an important factor.

One industry spokesman says that even if all strikes were to be settled within the next week in both automotive plants and among supplier industries, the present situation of certain materials and components is such that peak production would not be attained for several months. Here are some of the contributing factors that have brought this situation about:

Strikes in various parts plants, such as the one that tied up the bearing industry for several weeks, have created shortages of parts which will not be made up for several weeks at the earliest. Even though settled, these stoppages have resulted in depleted or diminished stockpiles and output will not pick up fast enough to build a backlog to offset the increasing demand from manufacturers.

Lack of manpower, incredible though it seems, is holding up production in some parts companies. This is chiefly in foundries and other operations where hard manual work is required. A company in Grand Rapids, Mich., has had a standing offer for several months of a $50 reward to any employe who will bring in a new worker who will stay at least 90 days on a bumper-polishing job. Although the pay rate is $1.58 an hour, the company has yet to pay off in a single instance. This aversion to hard and dirty work is particularly noticeable in the castings industry and constitutes a genuine threat to volume automobile production.

OPA price ceilings and price relationships also have been a deterrent on production. Although most original passenger car components have been exempted from price control, certain ones still are under ceilings, such as castings. Truck parts also have not yet been exempted, although OPA has promised to do so soon. The price relationship element may be more troublesome than actual ceilings. In textiles, for example, manufacturers want to concentrate on higher-profit clothing items. The Government wants the industry to divert more manufacture to low-priced cotton clothing, whereas the automobile manufacturers are asking for yard goods such as osnaburgs, twills, headliner sheeting, etc., which generally are not high-profit items. One spokesman for the automotive industry asserts that unless more cotton is permitted for use in automobile fabrics, textiles will be a bottleneck to reaching car production much in excess of that prevailing in December.

Another problem of materials often overlooked is that of competition from other industries. It is estimated that the demand for cotton textiles of all kinds during the first quarter of 1946 will be one billion yards in excess of supply. That the huge backlog of orders was not diminished during the autumn months following V-J day is apparent from the nation-wide scarcity of clothing, and the effects are bound to be felt in the automobile industry. Steel is another example of supply exceeding demand. Non-integrated

(*Turn to page 72, please*)

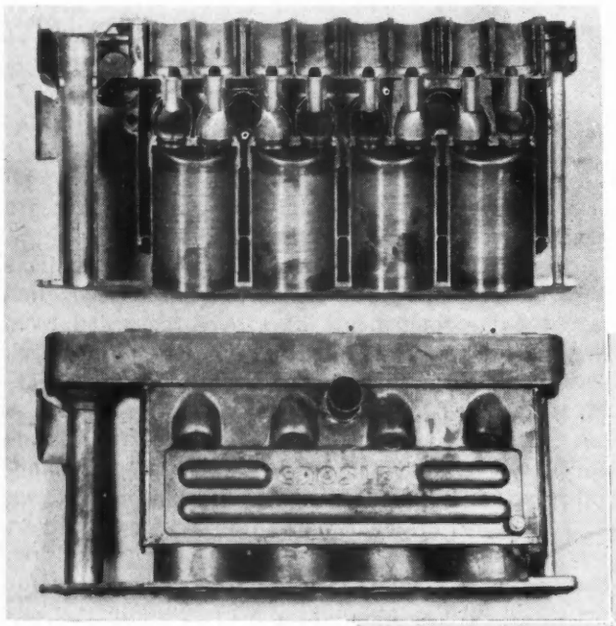
Full Details of the

ALTHOUGH all details of the 1946 Crosley passenger car are not yet available, Crosley Motors, Inc., Cincinnati, Ohio, has released complete data on its unique powerplant, which embodies unusual features of design and manufacturing processes, and a few details on the body, chassis, and car performance. It is possible to say at this writing that the 1946 Crosley will be a two-door sedan model, seating four, mounted on a wheelbase of 80 in., and tread of 40 in., and weighing about 1000 lb. Although the new car will be 28 in. longer and two in. wider than the 1940 model, its weight is just about the same. Major credit for weight economy goes to the newly developed engine. The previous model had a displacement of 35.2 cu in., developed 12.5 hp, and weighed 188 lb complete. By contrast the new engine develops 26 hp, and weighs 138 lb, complete with all accessories including generator and starter. It weighs but 59 lb without accessories.

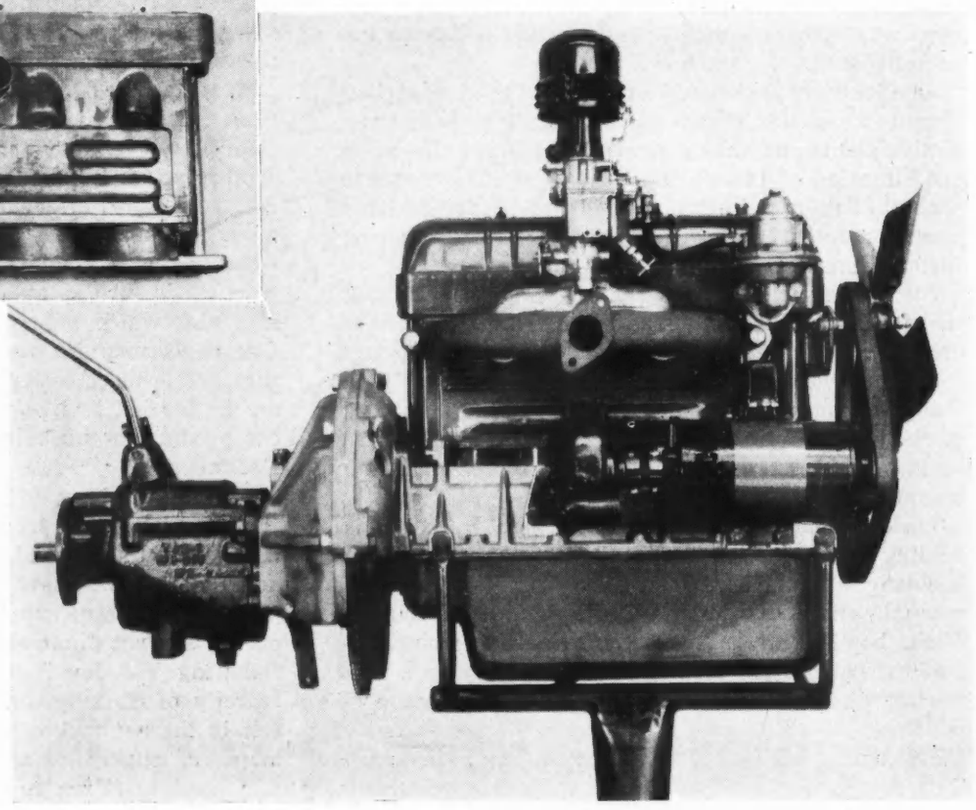
Maximum speed of the 1946 model is given as 65 mph. Fuel economy for this higher performance car is said to be even better than for the 1940 job. According to test results with a 1200-lb experimental car with 350-lb payload, they showed a fuel economy of 50 mpg at 30 mph, and 35 mpg at a speed of 55 mph. At maximum torque the specific fuel consumption is 0.48 lb per bhp-hr.

It is of interest to note that the development of this engine stems from the fact that Powel Crosley, Jr., learned of an all-steel stamped, copper-hydrogen-brazed engine which was being tested in 1943 at the Annapolis Experimental Engineering Station of the U. S. Navy. He found that the inventor of the engine was Lloyd M. Taylor of Taylor Engines, Inc., and made contact which later resulted in an exclusive license under the patents of the Taylor Engineering Co., Inc.

The Crosley engine was developed in Cincinnati by



Longitudinal cutaway section and left exterior of cylinder block and heads built of alloy steel tubing and sheet steel stampings.



Right side of the new engine for the Crosley 1946 passenger car.

Crosley-Taylor Engine

Major Features Include Composite Cylinder Block and Heads Made of Copper-Hydrogen Brazed Sheet Steel Parts, Five-Main Bearing Crankshaft of Cast Type, Overhead Camshaft and Valve Mechanism.

Crosley under the direction of Paul Klotsch, their chief engineer, in cooperation with Lloyd Taylor.

Specifications of the new engine are as follows: 4-cyl, valve-in-head, 2.5 in. bore by 2¼ in. stroke, 44 cu in, displacement, with maximum of 26 hp at 5200 rpm. The compression ratio is 7.5 to 1. As will be described later, the engine is fabricated of steel stampings, and consequently has stamped steel cylinder heads and steel cylinder barrels, the latter being formed from SAE 3140 material. Subsequent heat treatment of the fabricated assembly develops suitable hardness values for the various elements subject to heat and wear.

Pistons are of heat treated permanent mold aluminum with an aluminum oxide surface finish, camground, and weigh 4.92 oz each. Piston pins are of floating type with aluminum plugs at each end. There are three rings per piston—one oil ring and two compression rings. The drop forged connecting rods are tiny—4.125 in. center to center—and weigh 9.62 oz each. A feature of the rod is the use of integrally forged bolts which are machined directly in the forging. Connecting rod bearings are of precision steel-backed babbitt type.

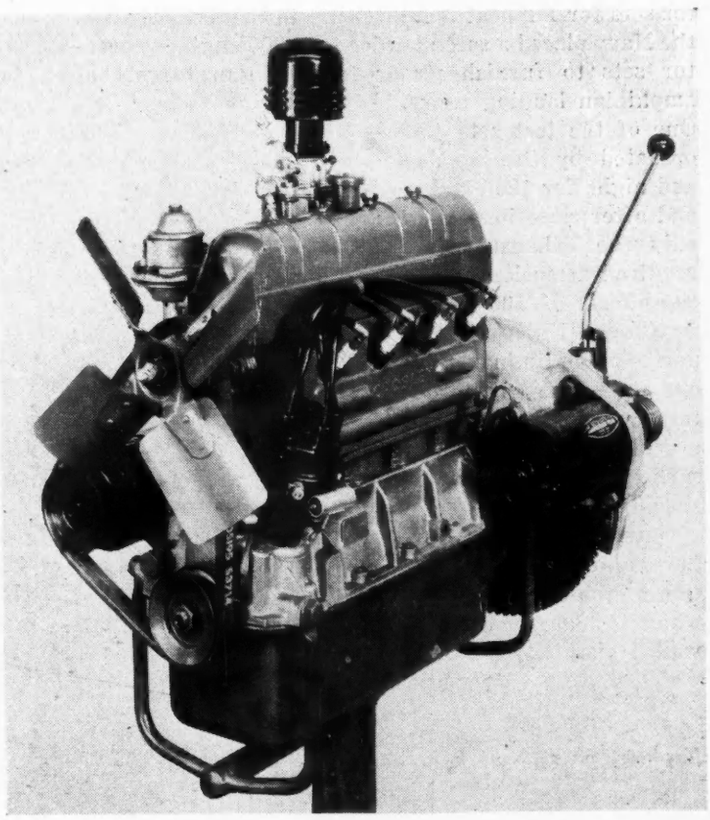
The crankshaft marks an interesting development for an in-line passenger car engine. Made of high strength cast iron, and fully counter-weighted, it is supported by five main bearings with the rear main taking the thrust. The journals are induction hardened. Dynamic balance of the crankshaft is held within ¼ in. oz and vibratory stresses do not exceed 4000 psi. One cast shaft underwent a 12-million cycle torsional deflection test, which stressed it to 6000 psi without failure. The main bearings are the precision, steel backed babbitt type, fitted with a clearance of 0.0015 to 0.003 in.

Intake and exhaust valves have heads of SAE 3140 steel. Carburetor is a Model DY-9B downdraft Tillotson, SAE ⅞ in. The front-mounted fuel pump and the air cleaner are supplied by AC. Auto-Lite electrical equipment is standard — Model IGW 4181 distributor, Model AB-13 battery of 80 amp-hr capacity, Model A-7, 14 mm spark plugs, Model AK starting motor, and Model GAS third brush generator with voltage regulator.

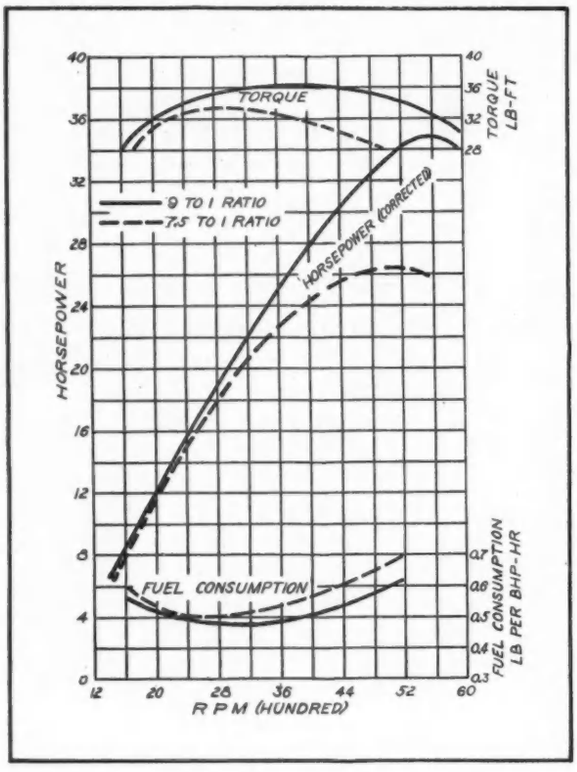
The clutch made by Rockford Clutch Division, Borg-Warner Corp., is of simple disk type with two molded-asbestos linings of 6-in. OD, 4-in. ID, ⅛ in. thick. A Warner Gear Model ASI-T92 three-speed transmission with manual control is standard.

The valve system, as illustrated, features a bevel gear drive. The vertical shaft is drilled to carry oil under pressure for the five camshaft bearings. The oil pump and distributor are driven by helical spur gears from the crankshaft. The oil pump, fan, generator, and water pump are driven at ¾ engine speed.

The engine has a full pressure system for lubrication, using a geared oil pump producing 50 psig pressure. The crankcase and flywheel housing are alumi-



Three-quarter front view showing left side of Crosley engine.



Performance curves of 1946 Crosley car engine (7.5 to 1 comp. ratio) and Crosley engine having 9 to 1 comp. ratio.

Engine 9 to 1 ratio—100 octane gasoline, venturi size 11/16 in. Engine 7.5 to 1 ratio—80 octane gasoline, venturi size 5/8 in.

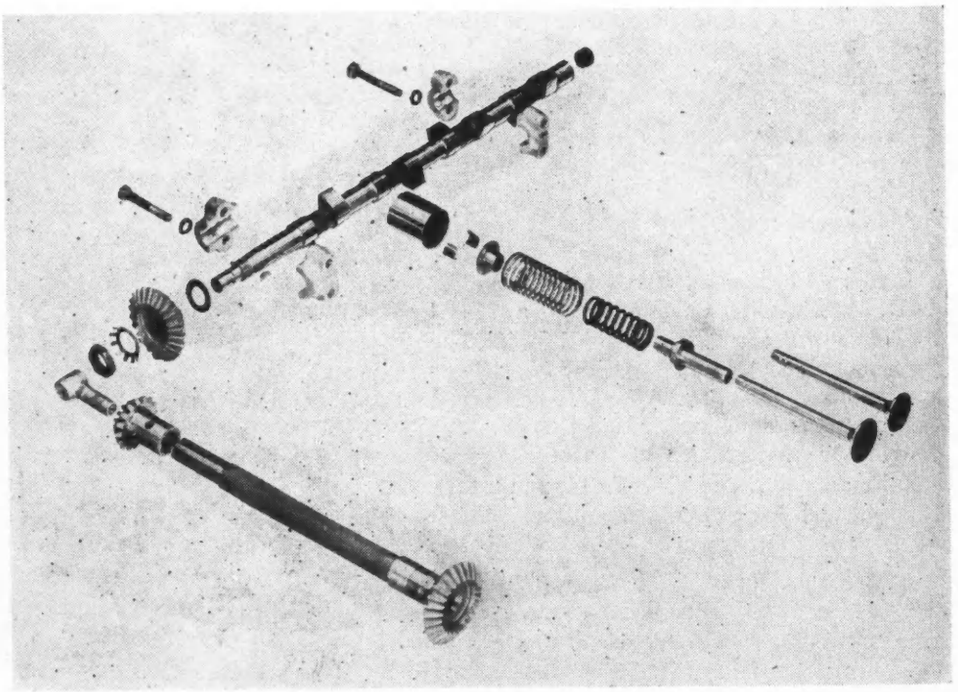
num castings, the oil pan is a steel stamping. The entire fabricated assembly is Bonderized before machining.

During the war the Bureau of Ships, U. S. Navy, which conducted the Annapolis tests, contacted Crosley for the construction of six experimental engine-generator sets for PT boat installation. In September, 1944, the Navy placed a second order for 2000 engine generator sets to furnish power for the gun turrets of amphibian landing tanks. One of the test sets was operated by Crosley day and night for 1200 hours, and after close inspection only the exhaust valves required attention due to the effects of 100 octane gasoline. Following a period of preliminary layout work, the engine details were fixed at the specifications outlined earlier and with a cylinder spacing of 3 in.

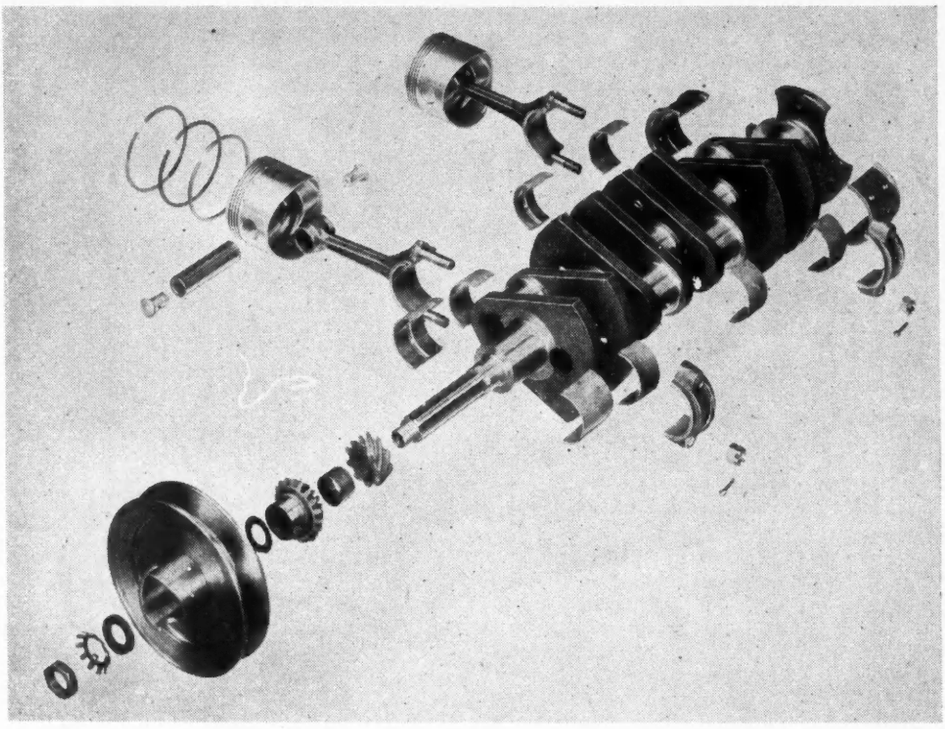
Outstanding feature of the engine is the construction of the cylinder block which is made up of light-walled alloy steel tubing for the cylinders and cam follower guides, and of sheet steel stampings for the cylinder heads, intake and exhaust ports, valve cases, and water jackets. These stampings number about 120 pieces for the block. The parts are held in place by shrink fits, spot weld or crimping operations and form a firm structure even before brazing.

The assembly is then copper brazed in a specially constructed furnace at 2060 F in a neutral atmosphere, after copper in sheet, wire, or paste has been applied to the joints. The furnace, which is 60 ft long, consists of a pre-heat chamber, where the cylinder block is gradually brought up to the brazing temperature; the brazing chamber, where the temperature is maximum; and the cooling chamber. At a certain point in the cooling chamber, where the block has been cooled from 2060 F to about 1500 F, a cool neutral atmosphere is introduced into the furnace and allowed to circulate around the brazed assembly, which is thereby quickly cooled to about 1100 F. The speed of this temperature drop determines the hardness of the cylinder walls, cam follower guides, and intake and exhaust valve seat inserts, which are made of alloy steel. The cylinder barrels harden to about 280 Brinell and the valve seat inserts, which are made from a high carbon tungsten vanadium alloy, harden to about 450 Brinell. The warpage is held to about 1/64 in. in 16 in. by properly designing the stampings as to the height of extrusions, control of press fits, and rate of pre-heat and cooling in the brazing furnace.

The fabricated cylinder block weighs 14.8 lb before machining, which consists of a light cut off the bottom cylinder plate and the top camshaft bearing and of



Exploded view of camshaft and valve mechanism.



Exploded view of crankshaft and piston assemblies.

boring and honing of the cylinder walls and cam follower guides. Only ½ lb of metal is removed during this machining.

The inside of the water jacket is covered with a clear, hard coat of plastic which, after baking, becomes so durable that it cannot be removed in a stripping tank of a strong caustic or acid solution. The material of the jacket is 20 gage, SAE 1010 sheet steel and the sides are ribbed in such a manner that nothing detrimental occurs to the block of the water in it if frozen solid. The crankcase is only 3 in. high, weighs 7¾ lb, and is a permanent mold aluminum alloy casting. The hold-down bolts for the cylinder block extend through the case to the main bearing caps.

The overhead camshaft is drilled the full length for the pressure lubrication of the five aluminum camshaft bearings. The cams actuate hardened and ground valve lifter, which are guided in alloy steel bushings in the cylinder block.

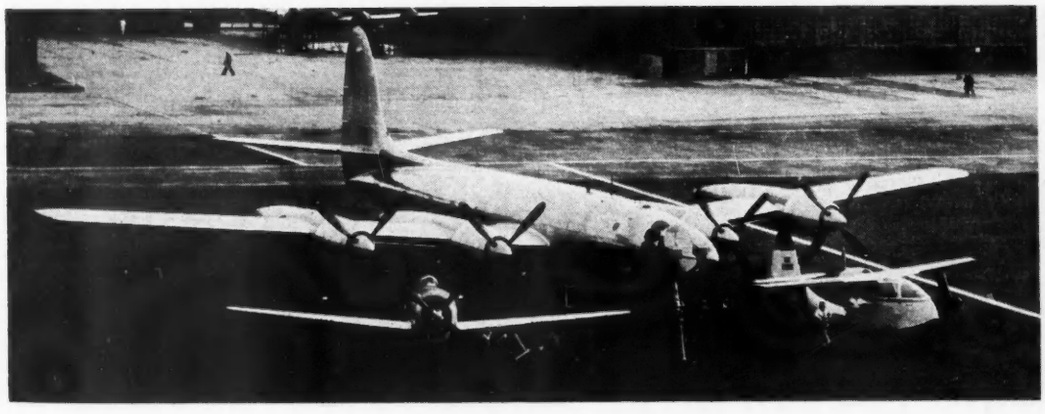
In addition to the stamped cylinder block, the crankshaft pulley, fan assembly and fan pulley, and the water pump impeller and pulley are made from copper-hydrogen brazed stampings.

The cooling system holds five quarts. The lubricating system, including the oil filter, holds three quarts.

The engine is suspended in the frame of the car at three points. The rear engine mount is located between the frame crossmember and the transmission, and the two front engine mounts are bolted to the front right and front left of the crankcase, at such an angle that the rubber which is bonded to the brackets is in shear only. The thrust from the rear wheels is carried through the torque tube over the engine mounts into the frame.

High economy is attributed to the high compression pressure. The lack of detonation is due to the cool combustion chamber where preignition is prevented during compression. The maximum wall thickness at any point separating the combustion chamber from the cooling water is .125 in. Because of the uniform substantially thin walls of the fabricated steel construction, including the portion between the valve seat inserts, and because of the generous contact between these walls and the cooling medium, a much more even heat distribution is obtained. This prevents the accumulation of heat in certain areas, avoids hot spots, eliminates pre-ignition and permits compression ratios of 9 to 1 to be used successfully.

The company is studying the many possible uses of this engine for other applications. Among those being considered are: for marine and industrial use, for farm implements, generator sets, for auxiliary air conditioning equipment, and for small farm tractors.



Republic XF-12

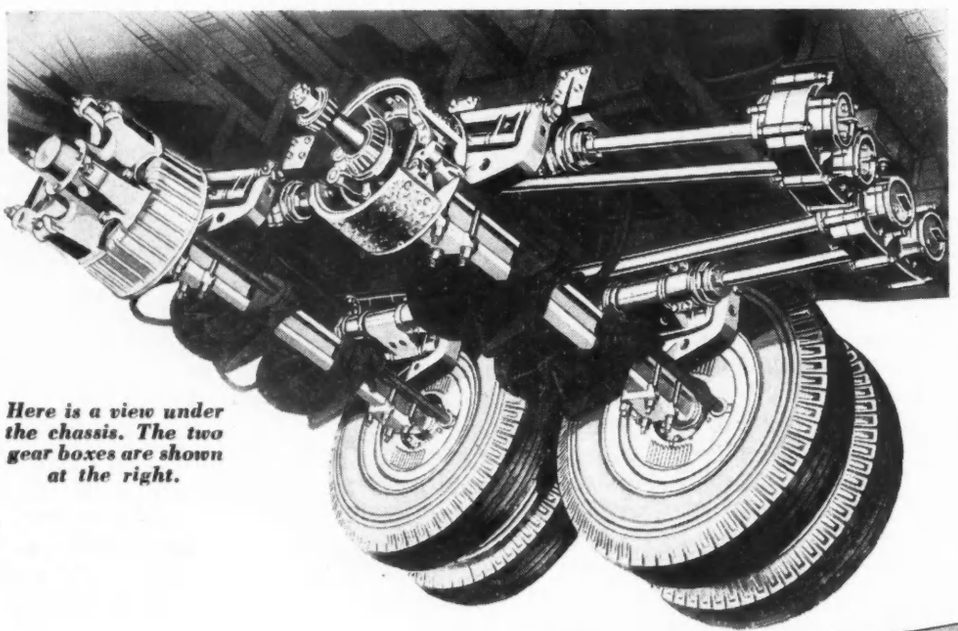
This new photo reconnaissance plane is nearly 100 ft. long and has a wing spread of 129 ft. It is powered by four Pratt & Whitney Wasp Major engines, each developing 3000 hp. Shown for comparison are a P-47, and a four-place amphibian, "Seabee", which is Republic's first postwar personal plane.

Torsion Bar Suspension

on Fruehauf Tandem

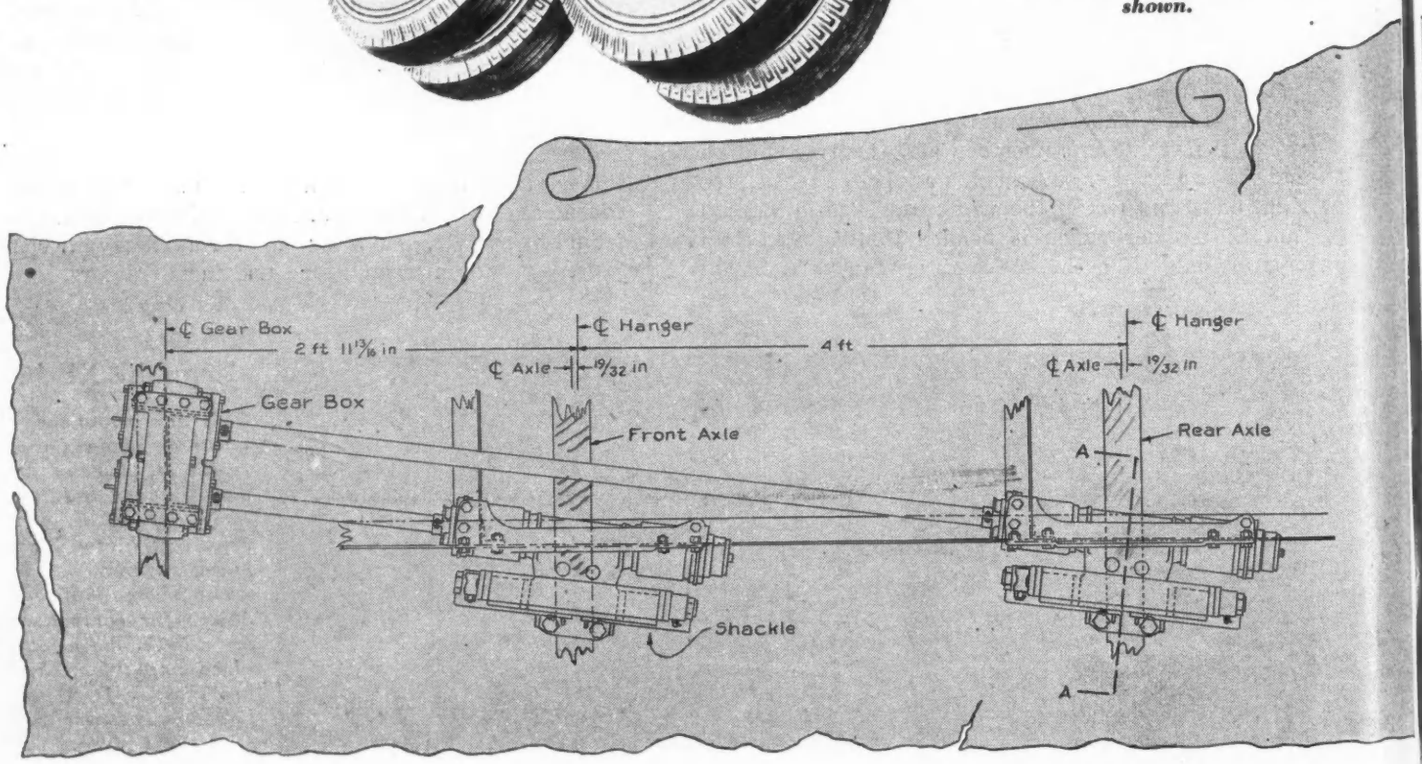
MARKING the first departure from traditional methods of spring suspension for heavy duty vehicles, the Fruehauf Trailer Co., Detroit, Mich., has announced the adoption of its revolutionary system of "Gravity Torsion Bar Suspension" as standard equipment on its entire line of tandem axle trailers. An exclusive license for the use of this development in trailers has been obtained from the Truck Equipment Co., holder of the patents. There is said to be no appreciable difference in weight between the Fruehauf torsion bar and comparable conventional suspension units.

Although the basic principle of the torsion bar suspension system has been available for some time, its application to the Fruehauf line took considerable effort by way of engineering design and ex-



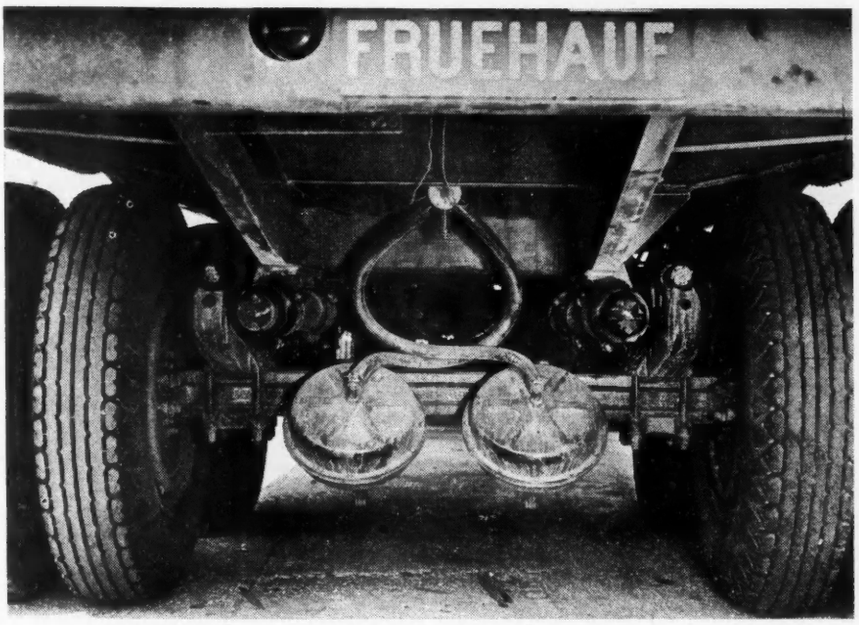
Here is a view under the chassis. The two gear boxes are shown at the right.

Below is a plan view of Fruehauf torsion bar suspension system (left side). Front ends of the parallel torsion bars are housed in a gear box, which serves to equalize the loads on them. At each axle the respective torsion bar is mounted in a swinging shackle. A sectional view of the rear axle shackle also is shown.



System

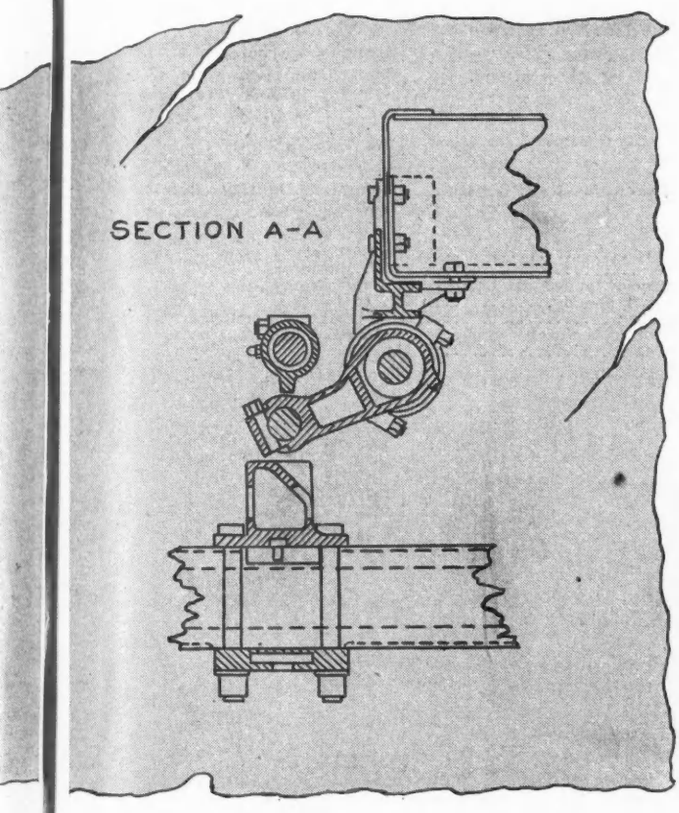
Axle Trailers



Rear view showing the mounting of the shackles on the rear axle pads. The torsion bars terminate in the cylindrical portion of the shackles mounted to the subframe.

perimentation before the sweeping change could be adopted and readied for production. A number of vehicles have been in operation almost two years, under constant control, while a large number of new vehicles were placed in operation in various regions recently before the design was finally approved for introduction to fleet operators.

As shown in the drawing of the installation on the left side, the suspension incorporates longitudinal torsion bars, one for each axle and terminating in a gear box forward of the front axle. This arrangement is the same on both sides. The rear ends of the torsion bars are fixed in the shackles as shown in cross-section. Unique feature of this design is the fact that the axes of the shackles and torsion bar are inclined toward the center of the chassis, thus imparting self-steering ability to the rear wheels.



The gear boxes contain a pair of one-to-one load-equalizing gears for each side. Their function is to serve as a torque divider so as to load each torsion bar equally regardless of the movement of wheels on each side with respect to each other. Thus if one wheel deflects while the other is level, part of the torque on the one torsion bar will be transferred to the mating torsion bar so as to equalize the loading.

Some of the basic features of the suspension from an over-all standpoint are important. In the first place, the axles have freedom of movement independent of the frame and body. The entire load is suspended on the shackles, permitting the cushioning of road shock both in the lateral and vertical directions. Lateral movement is so controlled that any tendency to tip the trailer due to side forces causes the vehicle automatically to bank against such forces. Another feature of the design is that no brake torque loading or horizontal road shocks are transmitted to the torsion bars. Instead, the resulting reactions are transferred directly into the rigid frame, thus eliminating tendency to wheel hop or chatter when the brakes are locked.

Freedom of lateral float of the tandem axles permits of automatic steering or trailing of axles on turns of 240 ft radius or greater. This is said to practically eliminate tire scuffing for all normal forward travel and also to reduce the pulling effort on curves as well as on the straightaway.

By virtue of the proper disposition of shackles the spring rate and frequency is low at light loads and increases in stiffness progressively with increase in load. The geometry of the shackle mounting is such that it is impossible to bottom the load or to overload

(*Turn to page* 48, *please*)

Details of Chrysler 2500 Hp.

ALTHOUGH the wartime achievements of Chrysler Corp. are well known, one of its most important projects—the development and experimental production of a unique inverted V-16 military airplane engine of 2500 hp output—remained a military secret until almost three months after V-J Day. Actually, the development was undertaken at the request of the Army Air Forces before this country entered the war, in anticipation of the need for a high performance liquid-cooled engine for combat service. Heading the list of desirable characteristics was the requirement of small frontal area combined with maximum power. Into this project Chrysler crowded its background of many years of experience in building high performance automotive engines and made available the technical skill and research facilities of its entire engineering organization.

Considering the great expenditure of time and money involved, the conception and progressive development of engine details, of foundry and machine shop problems, of materials and their treatments, and the host of other problems that required solution are beyond the scope of this article. Consequently, this

Specifications of Model XI-2220-11

Ratings:
- Takeoff—2500 bhp/3400 rpm/72 in. Hg obs.
- Military—2500 bhp/3400 rpm/30,000 ft
- Normal—2150 bhp/3400 rpm/30,000 ft
- Cruise—1450 bhp/2800 rpm/25,000 ft

General Form:

Bore	5.8 in.
Stroke	5.25 in.
No. of cylinders	16
Total piston displacement	2219.2 cu. in.
Cylinder Arrangement	60 deg. inverted V
Cooling	Liquid
Compression volume ratio	6 to 1

Crankshaft:

Material	AMS 6415 (SAE-4340) steel
Main journal diameter	3.25 in.
Crankpin diameter	3 in.
No. of main bearings	10
No. of crank throws	8
No. of Counterweights	4 (Integral)

Bearings:

Connecting Rod	SAE 1020 or 52100 steel shell
Material	Silver—0.010 to 0.020 in.
Crankpin Surface	Lead—0.0006 to 0.0009 in. Indium—5% lead

Pistons:

Material	AMS-4145 (32 ST) Aluminum
Type	Plug type with 3 compression and 2 oil rings

Valves:

Number per cylinder	2
Material	
Intake	Wilcox-Rich Silcrome—XBe
Exhaust	AMS-5700 Valve Steel
Seat Angle	37 deg. 15′ to 37 deg. 30′
Lift	0.576 in.
Diameter	
Intake	2.984 in.
Exhaust	2.687 in.

Valve Timing:

Inlet open	46 deg BTDC
Inlet closed	70 deg ABDC
Exhaust open	70 deg BBDC
Exhaust closed	46 deg ATDC
Provisions for adjusting	None

Ignition:

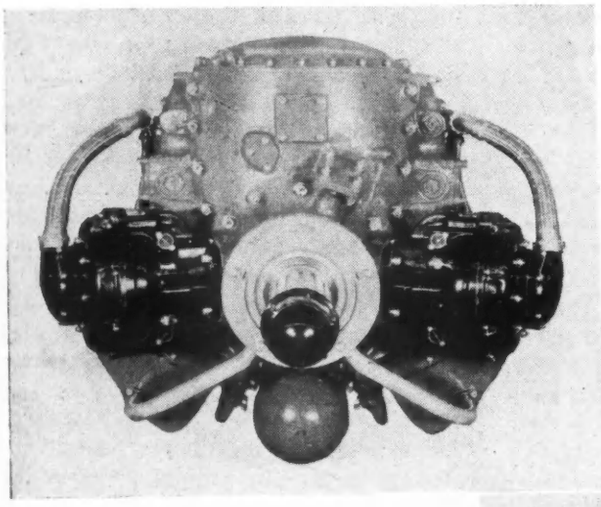
Type and Description	High tension magneto
Timing	35 deg BTDC (Static)

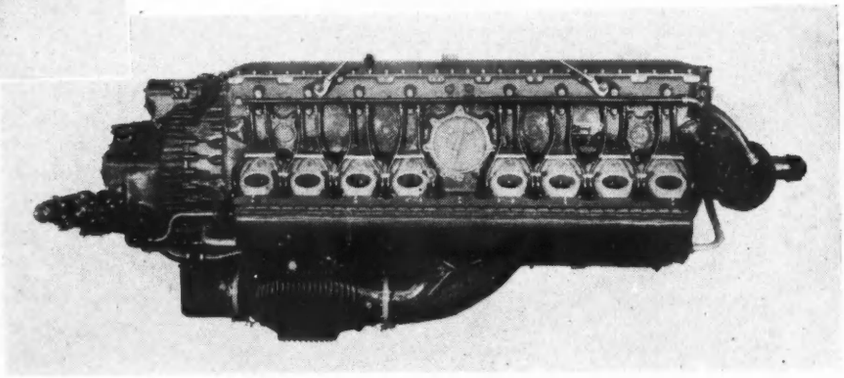
Carburetor:

Number	1
Vendor	Bendix
Type	PD-16-D1
Altitude Mixture Control	Automatic Density Compensator

Blower:

Type	Centrifugal
Size	11 in. diameter
Ratio of speed to crankshaft speed	6.46 to 1
Gearing	Double set of spru gears
Coupling, clutch, spring, etc.	None

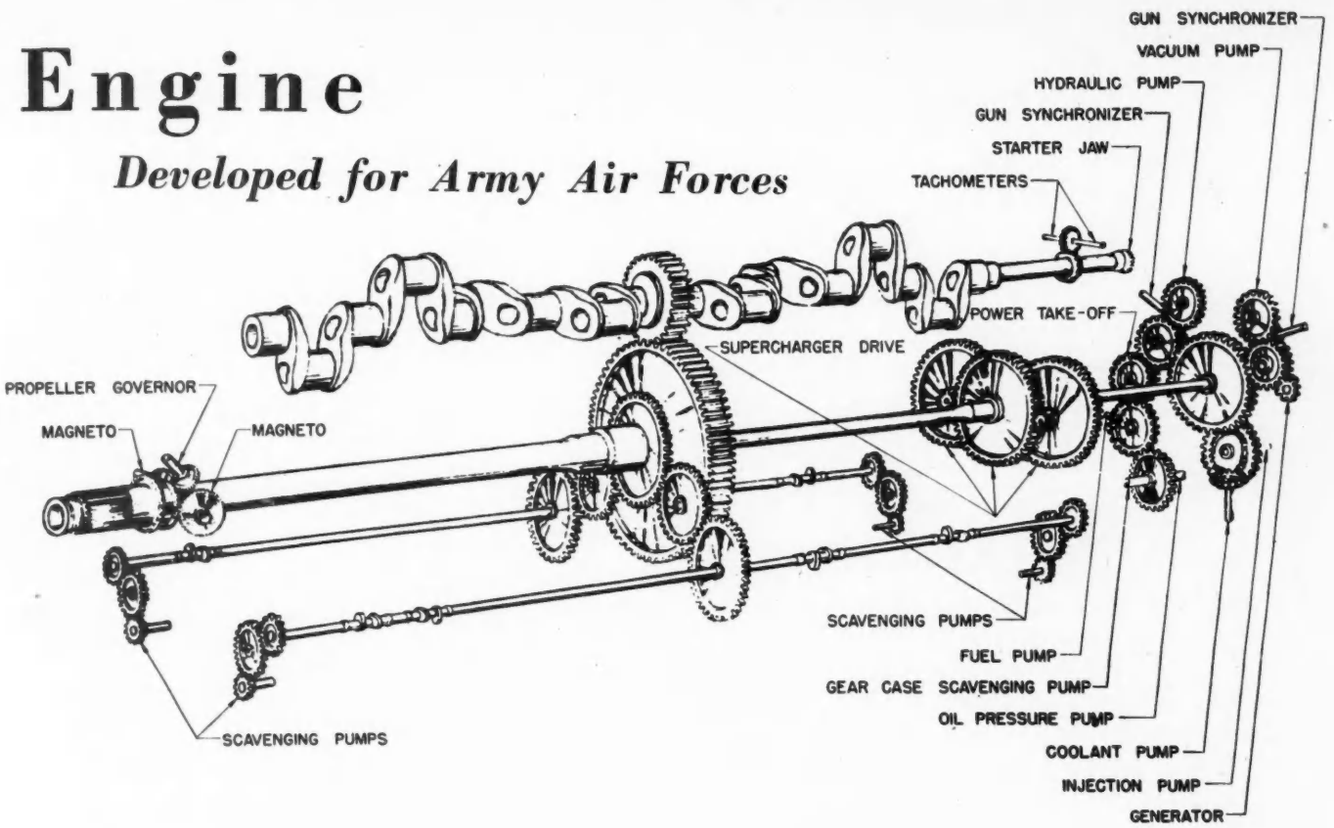




Side and front views of the Chrysler airplane engine. Overall length of the engine is about 125 in. The two magnetos are mounted at the front.

Engine

Developed for Army Air Forces



Diagrammatic sketch of the complete torsional system of the Chrysler engine. It consists of two crankshafts that transmit power through the reduction gear at the center to the propeller and accessory drive shafts, and the camshafts.

article is confined primarily to a description of major constructional details.

The Chrysler engine is known as the Model XI-2220. It is a 16-cylinder, inverted 60 deg V type, bore 5.8 in. by 5.25 in. stroke, displacement of 2219.2 cu in., and compression ratio of 6.3 to 1, rated 2500 hp at 3400 rpm. It is liquid cooled, using ethylene glycol as the cooling medium. Power to displacement ratio is 1.13 bhp per cu in. Since fuel economy is of vital importance in military planes, it is interesting to note that this engine is capable of specific fuel rates as low as 0.42 lb per bhp-hr at its maximum cruise of 1450 bhp. Some general features of the development may be outlined as follows:

1. Small Diameter—to allow good visibility in a combat plane, and to permit engine cowling in the form of a figure of revolution about the propeller shaft. The nominal diameter of 33.5 in. not only permits of a nose installation but facilitates submerged installation in wing or fuselage.

2. High Speed—high rotative speeds without exceeding practical values for piston speeds are permitted by the short stroke.

3. Elimination of Vibration—not only is the engine inherently free from torsional vibration of the elastic system but transmitted vibration and induced engine loads on the airframe are minimized. The latter is accomplished through the adaptation of a form of Chrysler's Floating Power, consisting of a three-point mounting—one point at the rear end, and the two principal points of support at the center of the engine in the plane of the main reduction gearing.

3. Simplified Manufacturing—this was a basic consideration to the end that the acceptable design would be suited to mass production. Many of the basic parts are interchangeable and lend themselves to quantity production. Moreover, the assembly and servicing operations have been simplified to a marked degree.

CRANKSHAFT—The crankshaft assembly consists of two separate shafts flanged at one end and bolted to the crankshaft reduction gear to form an integral unit, each section having four crankpins and five main bearing journals. By analysis and by test it has been found that the reduction gear is a nodal point location so that no torsional vibration from the major mode is transmitted through the gearing. The diagrammatic layout of the torsional system is shown on this page. It is claimed, in general, that torsional vibration, one of the most annoying problems in aircraft engine design, is so effectively reduced from the operational standpoint as to present no problem. Since torsional vibration is inherently within the allowable amplitude, vibration dampers are not required to eliminate the danger of torsional fatigue at rated outputs.

Examining the illustration above it will be noted that power is transmitted from the crankshaft to the large bullgear which divides output power in two directions—forward to the propeller hub through

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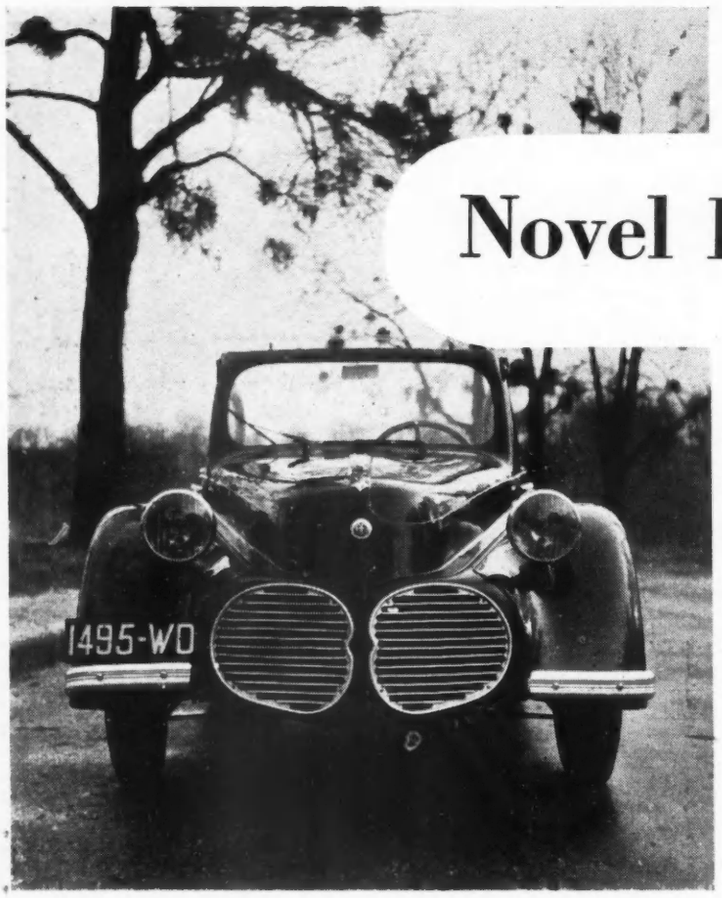
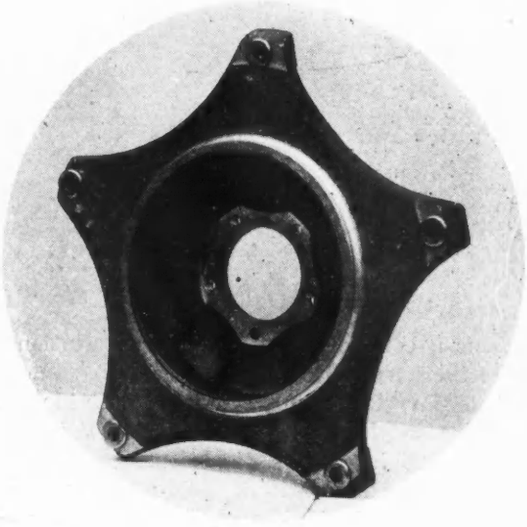
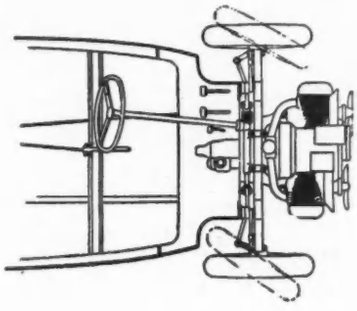
Novel Design Features



(Left) Front view of Gregoire experimental model.

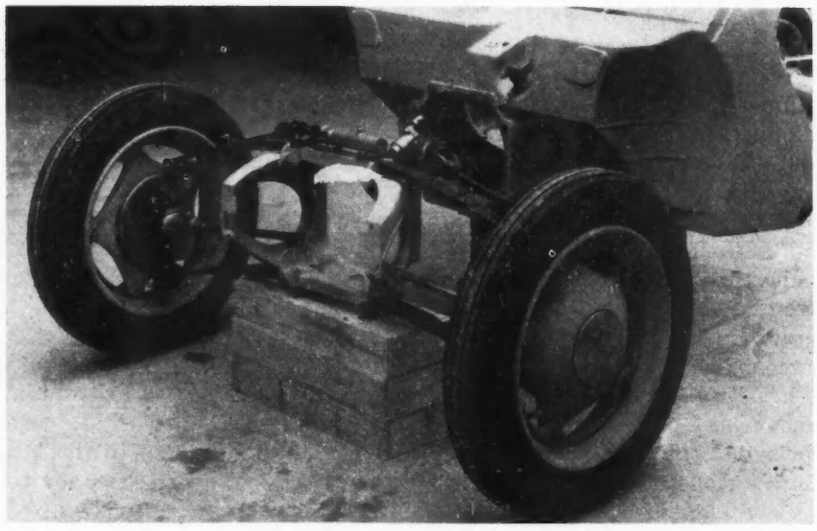
(Circle) Light alloy brake drum with nitrided iron liner. A light alloy rim is bolted to the five-branch spider.





(Left) Front chassis layout showing location of powerplant and front suspension.

(Below) Cradle for mounting transverse leaf springs, powerplant and steering gear on French car.



OPERATING economy is going to be the main target for European automobile designers for many years to come, and in pursuit of this goal, light metal alloys are coming into more extended use and, retrograde though it may appear to be, the number of cylinders is being reduced to two. The first of these economy cars—probably a dozen different types have been built experimentally—is the work of the French engineer, G. A. Gregoire, of the Simca (French Fiat) Co., near Paris. Gregoire will not build the car in his own factory, at any rate for a year or more, but the designs have been sold to an English group, Grantham Productions, Ltd., which has been licensed to build and sell the Gregoire car in Great Britain and the British Empire. The French version of the Gregoire car is a four-passenger model weighing 948 lb,

By W. F. Bradley
Special Correspondent of
AUTOMOTIVE and AVIATION INDUSTRIES in France

of the Gregoire Lightweight Car

having a maximum speed of 56 mph, capable of an average of 43 mph over long distances, and running 59 miles to the American gallon. The English model is said to weigh less than 900 lb. The wheelbase is 78½ in. and the tread 48 in.

Aluminum alloys are largely responsible for the low weight. The car is built around an Alpax casting comprising two frame members, a forward bulkhead, the cowl and the windshield frame. These are five separate castings, dovetailed and bolted together and united at the rear by a big diameter tube. The entire structure weighs 100 lb. This feature is covered by Gregoire patents and first made its appearance in 1938, when Hotchkiss built a limited number of cars to the Gregoire design.

An Alpax casting cradle carries the front suspension, consisting of super-imposed transverse springs and hydraulic shock absorbers;

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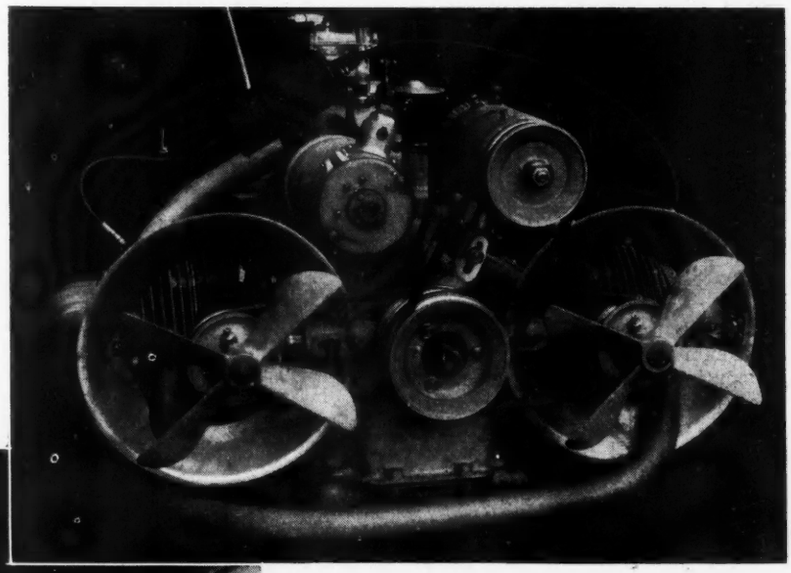
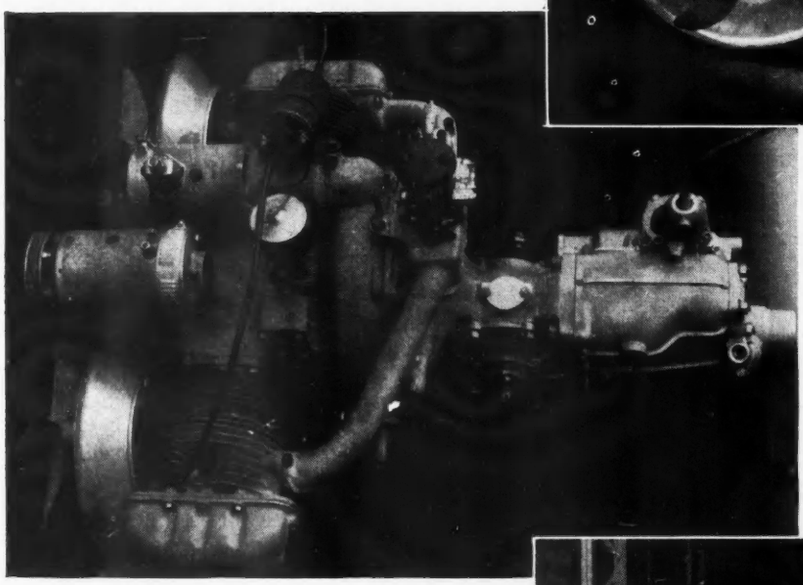




(Above) Front view of engine. Fans can be declutched at will.

(Left) Looking down on Gregoire car engine at left side. The drive for the front wheels is taken from between the clutch and transmission.

(Below) Aluminum frame of Gregoire car. It consists of five castings totaling 100 lb.

Airbriefs

By Henry Lowe Brownback

Museum

Lately nearly everyone closely connected with aviation received an inquiry from General Arnold about his scheme for an aeronautical museum. The idea is good and should have the backing of everyone interested in aeronautics. I hope that, for once, the Government will build a museum worthy of the American people. My good friend Paul Garber who laboriously gathered a collection of aeronautical treasures for the National Museum has had to be content to store them in an old metal shack back of the Smithsonian Building, which has but a fraction of the room needed and where a small fire could wipe out a collection of tremendous value that could never be replaced.

In fact the entire National Museum is an old fire trap, antiquated in appearance and construction, yet housing some of the world's greatest treasures. Some day after the whole thing has gone up in smoke, or been ruined by water in an attempt to save it, we may see the Congress wake up to the fact that it is miserly to the last degree on projects of great value to the nation, but without that vote-getting appeal so delightful to our elected representatives. We can spend billions paying men to loaf, and more billions to pay farmers for not raising crops, more billions to enable the British to install a Socialist Regime and to the Russians to promote Communism throughout Europe and to finally poison the system of government and industrial organization which is so "bad" that it has given us the highest standard of living in the world, more billions to run a lot of second rate politicians, posing as statesmen, all over the world on every possible excuse for a free junket, but we can't seem to find the few dollars necessary to build a really dignified and adequate museum to house the concrete story of the technical advance which has made us great.

I have one fault to find with General Arnold's idea. He wants to start with the airplane while one of the most glorious episodes of American military aviation was the Civil War Balloon Corps credited with winning several of the most important battles of that war and paving the way for much that is modern in aeronautics. A few of the relics of this corps may be seen in the metal shed back of the Smithsonian. Good luck, General Arnold, and I hope that your museum will be everything you might wish for. May I respectfully suggest that Washington is the ideal site. In fact the Pentagon Building with its vast floor area and ramps would make an ideal site for a new National Museum.

Parachutes

Many of my old World War I friends still recall visions of the Germans floating down in parachutes while our pilots were forced to ride their crippled planes to earth or perish. I have heard many claims of who was the first to design a parachute of the pack type. I have a copy of a report which I wrote in France in 1918 for the Bureau of Aircraft Production here, in which I noted this fact and recommended that we make parachutes for our men, that they should not be stored in the aircraft or attached to it as were the European parachutes, but should be in the form of a pack on the man's back or serve as a cushion. Today I saw a drawing of what is claimed to be the world's first man-carrying parachute. It is a huge canvas affair with a basket slung balloon-fashion below the chute. A Frenchman rode this job some 8000 feet to earth on what little data he had been able to collect. It is of this stuff that heroes are made!

Storing Power

Our most usual form of "storing" power in aircraft and motor cars has been the storage battery which stores nothing at all but simply undergoes a chemical change when giving out "juice" and changes back again when electricity is passed through it. The system is crude, heavy and slow, so it is interesting to see the adoption in this country of the French invention of storing energy by pumping hydraulic fluid into a closed vessel in which it compresses the air and this compressed air then drives the fluid, under very high pressure, into all sorts of devices such as direct acting cylinders, powerful small hydraulic engines and wonderfully light engine starters. This method of storing energy is light and quick. I had a friend in Europe who had one of these systems on a truck where it acted as the springing. He used a rig which looked like the old Westinghouse air springs, but connected it to a variable pressure hydraulic system so that the pressure could be raised with the load, giving a carrying capacity and ease of riding suited exactly to the loading.

Auxiliary Power

The big airplane is certainly coming fast. When planes were small their electrical power needs could be filled by generators driven from the main engines just as the electric power for a motor boat can be obtained from the generator on the engine and a battery. It is just as senseless to try and get the power for a big plane from this source as it would be to gear generators to the propeller shafts of a steamship.

It seems that the large airplanes of the future will need very efficient auxiliary power plants and some have already been manufactured. The proposition is not easy as the engines must operate at high altitude and be quiet, reliable and very light. In fact their weight per horsepower should not greatly exceed that of the main engines. Think what this means especially in view of the fact that the average mechanic will service the main engines far more carefully than the auxiliary. Airplane engines were never too light in small powers and the auxiliary engine will be relatively low powered—not over 10 to 15 per cent of the power of the main engines.

In 1925 we made what I believe to be the first such engine at Anzani and it developed 2½ hp. on a total of 22 pounds of weight complete with air cooling blower. Later we speeded the engine up and got 4 hp. from it.

I believe that this auxiliary service will finally be done through small gas turbines. The present gas turbines are bulky and not too efficient because of the fact that our present materials will not operate over long periods of time under the extreme heats needed to make the turbine as efficient as our best piston engines (I am not talking of combined turbine-jet units) and just as soon as materials which can be manufactured easily and cheaply which will operate in turbines running at temperatures of from 1800 to 2200 F. we will see remarkable progress.

I have never figured the weight of a small condensing turbine run from steam generated in a flash boiler heated by exhaust gas from a reciprocating engine or of an exhaust gas turbine running a generator rather than a super charger. These two last solutions are not ideal as they do not provide for operation of the auxiliary power plant when the main power units are shut down. I think that the wrong approach to the auxiliary engine is to condense an aircraft engine. I have often said this is connection with light aircraft engines. They are an entirely different problem than the large plane engine.

Large Crowds at First Postwar

Annual Meeting of SAE

Technical Papers Cover Wide Range of Subjects. L. Ray Buckendale Succeeds J. M. Crawford as Society President

By Joseph Geschelin

To a gathering of some 2500 SAE members and guests who crowded the banquet hall of Detroit's Masonic Temple, Henry Ford II, president of Ford Motor Co., posed the problem of human engineering and asked for concerted effort toward the betterment of relations between management and labor. A summary of his address is present on page 39 of this issue. The banquet also offered the first official introduction of L. Ray Buckendale, 1946 president of the society, who succeeds J. M. Crawford.

The annual meeting this year was a phenomenon of the postwar era. It was a veritable three-ring circus, with simultaneous sessions mornings and afternoons and the traditional but augmented product exhibit. The official registration of something over 3000 by no means pictured the throngs who attended. Our estimate is that easily 2000 people crowded the simultaneous technical sessions with hundreds standing for several hours. There are many reasons for the large attendance, not the least of which is that here was the first opportunity in over four years to present postwar ideas and perspectives.

From a technical standpoint the meeting program covered a tremendous range of interest and revealed many things covered by military restrictions only a short time ago. One of these was the paper on the new synthetic lubricants presented by a team composed of J. C. Kratzer, Linde Air Products Co.; D. H. Green, National Carbon Co., Inc., and D. B. Williams, Carbide & Carbon Chemicals Corp. The aircraft sessions with their revelation of the design details of jet engines and gas turbines, as well as displays of enemy engines, is another example.

Obviously, there was too much meat in the program to permit even of highlighting in a brief report. As a matter of fact, a summary of the most important papers will appear in early issues of AUTOMOTIVE AND AVIATION INDUSTRIES. Certain sessions, however, touched upon matters of such immediate importance as to make it desirable to make at least passing reference to them. The session on the driver's comfort with discussion led by O. F. Quartullo, Visioneering Co., Inc., was slanted specifically at the comfort and safety of the drivers of motor trucks, and attracted considerable attention. While there was general agreement that the cost of recognized improvements might be prohibitive in light vehicles, the tenor of discussion indicated the need for more comfortable seats, better vision and cab ventilation, as well as the possibility of using double window glass or defrosting equipment to keep glass clear of frost and steam.

The future of road transportation was viewed by a team of experts in their field—"Motor Trucks of the Future," by Robert Cass, White Motor Co., looking

(*Turn to page 74, please*)

SAE Officers for 1946

President

L. Ray Buckendale
Engineering vice president, Timken-Detroit Axle Co.

Vice Presidents

Aircraft Engineering—George A. Page, Jr., Director of Engineering, Curtiss-Wright Corp.

Aircraft Powerplant Engineering—Earle A. Ryder, consulting engineer, Pratt & Whitney Aircraft.

Air Transport Engineering—Charles Froesch, chief engineer, Eastern Air Lines.

Diesel Engine Engineering—H. S. Manwaring, chief engineer, Truck Research & Development Div., International Harvester Co.

Fuels & Lubricants Engineering—J. C. Geniesse, process supervisor, Research & Development Dept., The Atlantic Refining Co.

Passenger Car Engineering—J. E. Hale, chief engineer, The Firestone Tire & Rubber Co.

Passenger Car Body Engineering—Thomas L. Hibbard, assistant director, Design Dept., Ford Motor Co.

Production Engineering—Neil A. Moore, vice president, Sealed Power Corp.

Tractor & Farm Machinery Engineering—E. A. Petersen, chief engineer, Tractor Div., Massey-Harris Co.

Transportation & Maintenance Engineering—Ervin N. Hatch, senior automotive mechanical engineer, New York City Transit System.

Truck & Bus Engineering—Beverly W. Keese, engineering vice president, Wisconsin Axle Div., Timken-Detroit Axle Co.

Treasurer

B. B. Bachman, vice president, in charge of engineering, Autocar Co.

Council Members

A. E. Raymond, engineering vice president, Douglas Aircraft Co.

A. J. Blackwood, assistant director, Esso Laboratories, Standard Oil Development Co.

C. E. Frudden, consulting engineer, Tractor Div., Allis-Chalmers Mfg. Co.

J. C. Armer, vice president, Dominion Forge & Stamping Co., Ltd.

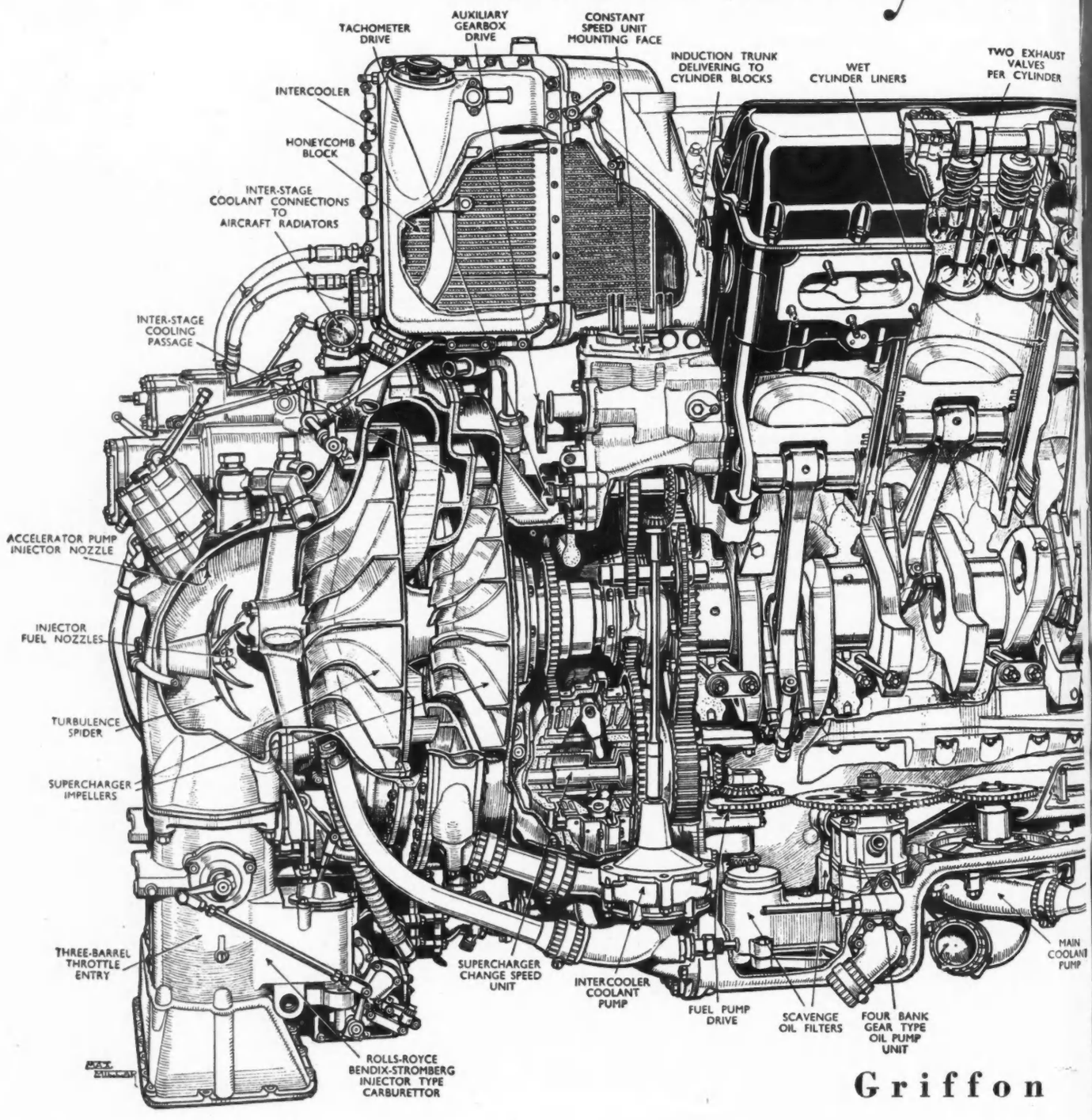
Fred C. Patton, manager, Los Angeles Motor Coach Lines.

R. J. S. Pigott, chief engineer, Gulf Research & Development Co.

J. M. Crawford, assistant to vice president, General Motors Corp.

W. S. James, director of automotive research, Ford Motor Co.

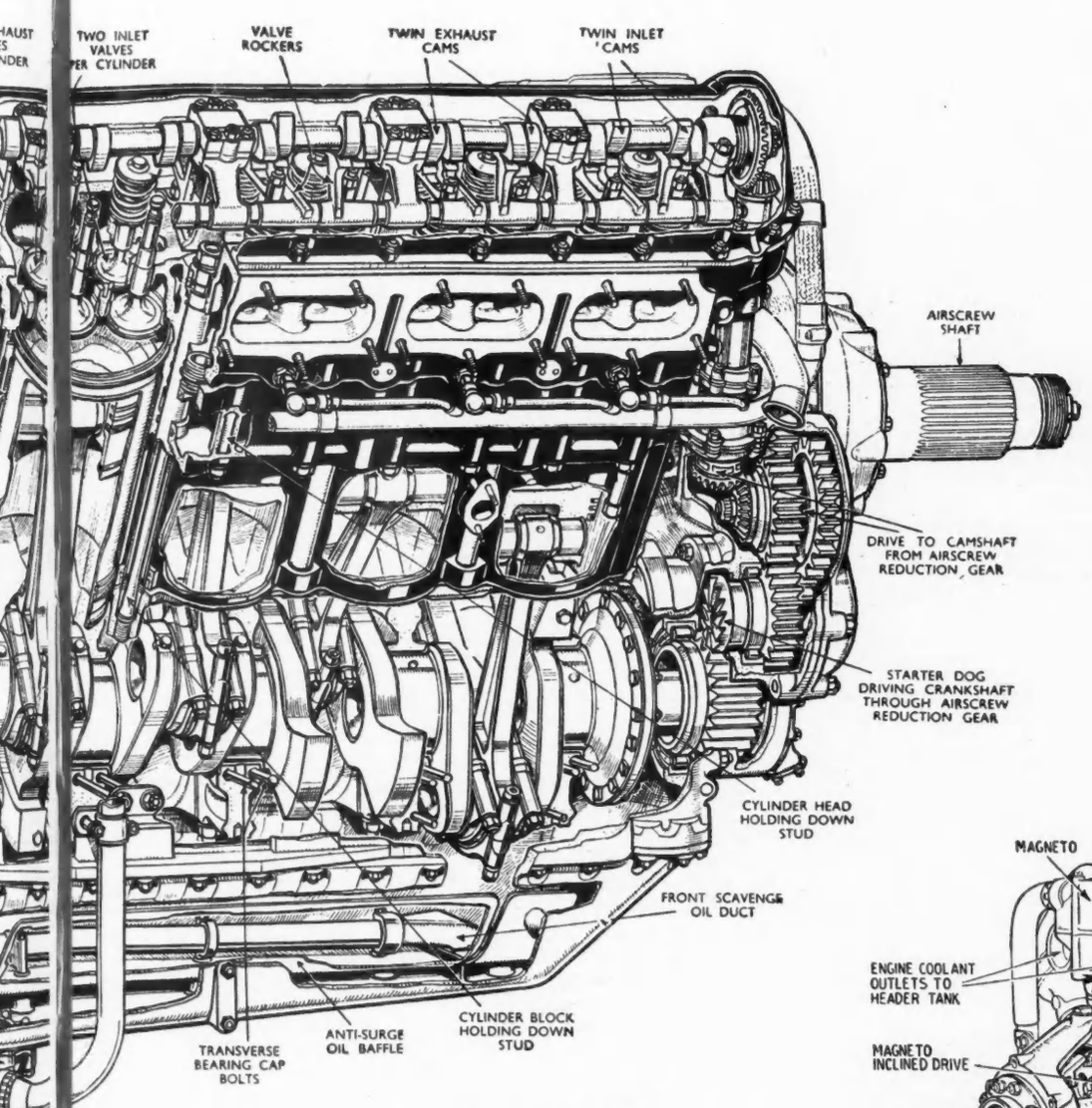
Rolls-Royce

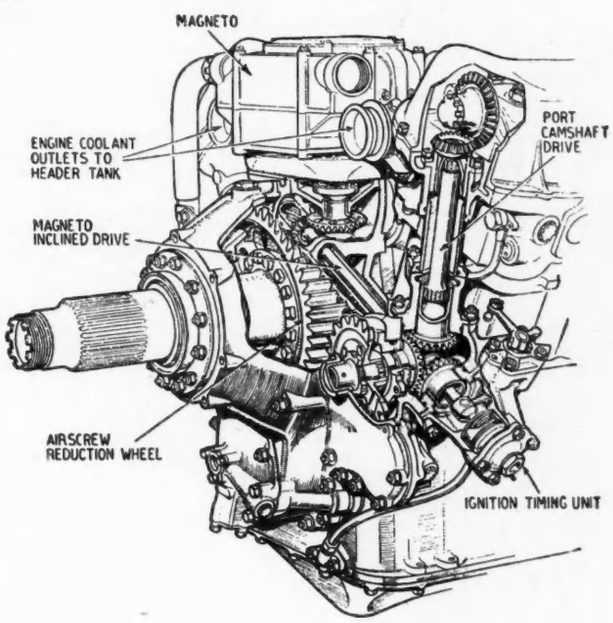


Griffon

Type	Pressure liquid cooled
Cylinders	12, two banks of six in-line at 60 deg. V.
Length	81 in.
Height	45 in.
Width	29.5 in.
Frontal area, bare engine	7.9 sq ft
Dry weight	2090 lb
Max bhp	2220 at 2750 rpm
Cruise rpm	2400
Max bmep	286 psi
Bore and stroke	6 in. by 6.6 in.
Total piston displacement	2239 cu in.
Propeller Gear ratio	0.5102 to 1
Main bearing diam.	3.75 in.
Main bearing areas	Center, 5.45 sq in. Ends and inters, 5.12 sq in.
Big end diam.	Fork rods, 3.10 in. Plain rods, 3.773 in.
Big end area	Fork rods, 6.28 sq in. Plain rods, 2.61 sq in.
Piston pin diam.	1.50 in.
Total piston pin bearing area	6.83 sq in.

Griffon (65) Engine


TWO INLET VALVES PER CYLINDER
VALVE ROCKERS
TWIN EXHAUST CAMS
TWIN INLET CAMS
AIRSCREW SHAFT
DRIVE TO CAMSHAFT FROM AIRSCREW REDUCTION GEAR
STARTER DOG DRIVING CRANKSHAFT THROUGH AIRSCREW REDUCTION GEAR
CYLINDER HEAD HOLDING DOWN STUD
FRONT SCAVENGE OIL DUCT
CYLINDER BLOCK HOLDING DOWN STUD
ANTI-SURGE OIL BAFFLE
TRANSVERSE BEARING CAP BOLTS



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Data

Con. rod length, center to center	10.65 in.
Valve timing	Inlet opens 24 deg before TDC, closes 44 deg after BDC. Exhaust opens 64 deg before BDC, closes 4 deg after TDC.
Inlet port area	5.45 sq in./cyl.
Exhaust port area	4.12 sq in./cyl.
Supercharger	Centrifugal two-speed two-stage with inter-cooler.
Max supercharge pressure	21 psi.
Max cruising boost pressure	7 psi

Engine and Braking Problems

Factors Pertaining to the Installation of Inverted, In-Line Air-Cooled Aircraft Engines

By T. F. HAMMEN, JR., and W. H. ROWLEY
Ranger Aircraft Engines

FOR-ANALYZING those factors involved in the installation of the inverted, in-line type of air-cooled aircraft engine, the material is developed to emphasize consideration singular to this particular type of engine, and the information presented is based primarily upon experience gained from wind tunnel and flight tests with Ranger engines. The material is arranged under six major headings: Cooling Aspects; Cowling Arrangements; Oil Cooling Systems; Induction Systems; Engine Mounts; and Exhaust Systems. The topics are presented with respect to both the scope of their application and their degree of interest to the industry. The section which discusses the cooling aspects of Ranger engines deals primarily with the 12-cylinder series.

Engine cooling, despite the vast amount of research work expended on it, remains one of the foremost problems confronting aircraft and engine manufacturers. This problem is the one which probably requires the greatest joint effort on the part of both. The study of cooling may be divided into two principal phases. One is the study of heat flow within the engine and its component parts, including the effect of cylinder design, development of optimum finning, choice of materials, and baffling arrangements affording optimum dissipation to the cooling air stream. The other phase, more important to the installation engineer, deals with the flow of cooling air and its efficient utilization. Paramount in the treatment of the latter phase is pressure cooling.

The principle of pressure cooling involves an air pressure chamber or reservoir on the upstream side of the engine cylinders, and cylinder baffling controlling and directing the high pressure air in motion to assure its efficient utilization. The downstream side of the cylinders is in a low pressure zone toward which the high pressure air will flow. The pressure in this area may be further reduced by the use of cowl flaps; this results in a higher pressure differential and greater air flow.

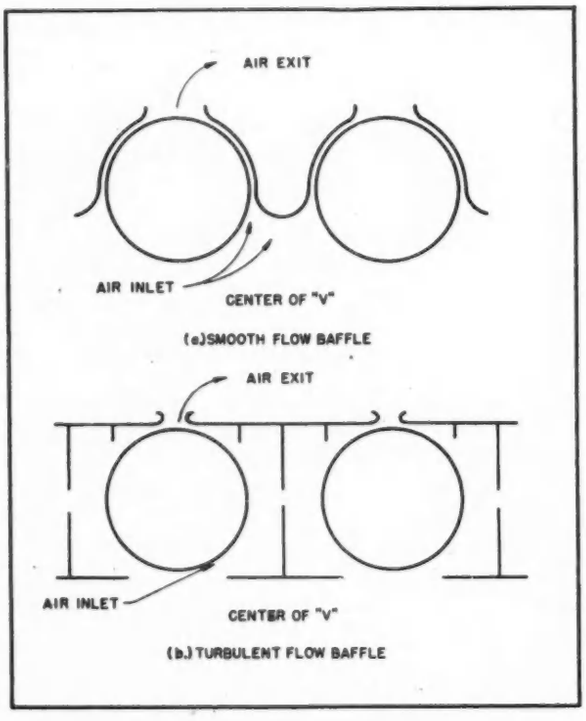

Fig. 1. Comparison of cylinder baffling of a conventional in-line, air-cooled installation, and the Ranger developed "Turbulent Flow."

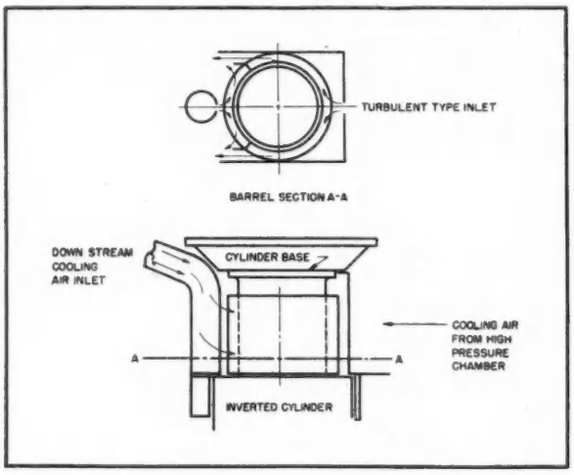

Fig. 2. General principle of "Bi-Polar Cooling" showing air flow and baffle arrangement.

Fig. 1(a) illustrates conventional, in-line, air-cooled cylinder baffling. The baffles are designed to direct the air toward the cylinder on the downstream side. On the upstream side the baffles are sometimes omitted because adequate cooling is available. A new development has modified this somewhat. Fig. 1(b) illustrates schematically the Ranger developed "Turbulent Flow" baffle, which completely boxes the cylinder. Emphasis is placed upon inducing local turbulence within the area confined by the baffle in the interest of "scrubbing" action to maintain maximum thermal potential between cooling-fin and cooling-air. Attention is directed to the small auxiliary vanes within the baffle installed to assist in promoting turbulance. Engines thus baffled display reduced air flow requirements for equivalent cooling. This results in lower required cooling power, lower required exist flap angles, and smaller engine cooling-air entrances.

An additional development relating to cooling-fin construction has resulted in improving the heat transfer of a finned cylinder to the cooling-air stream, a measure necessitated by the higher specific output resulting from recent advances in engines and fuels. The low conductivity of

at SAE Aeronautic Meetings

AT RECENT meetings of the Southern California Section of the Society of Automotive Engineers held at Los Angeles, technical papers were presented on timely aeronautical subjects, among which were the simplification of the study of crankshaft torsional vibration by using a newly-developed electrical system, helicopter engine requirements, installation problems in connection with turbo-jet powerplants and inverted in-line air-cooled engines, deaeration of engine oil, weight reduction using reverse thrust propellers, power brake valving, and others. Abstracts of a number of the papers are given herewith:

the steel barrel-cooling-fins used in early designs presented a recognized bottle-neck in the heat flow to the cooling-air stream. A substitute material possessing high conductivity, light weight, and workability was sought. The major problem was that of bonding the material to the steel cylinder barrel. This was accomplished by what is now known as the Al-Fin process whereby an aluminum muff, into which cooling fins are later machined, is chemically bonded to a cylindrical steel shell to form the cylinder barrel.

In addition to the development of the Al-Fin cylinder and the turbulent flow baffles, a third measure, concerned with the methods of delivering the cooling- air to the cylinders, is now under investigation. This system is known as "Bi-Polar Cooling," and delivers cooling-air to both the downstream and upstream sides of the cylinder. Air enters the baffled zone (Fig. 2) from both the inboard or 0 deg. position and the outboard or 180 deg. position. Air from both sources is exhausted at the 135 deg. position which is aft, 45 deg. outboard. It is expected that installations employing "Bi-Polar Cooling" will require approximately the same total cooling-air flow as the conventional full pressure cooling installation. However, because only approximately 80 per cent of the total cooling-air must pass completely across the cylinder, the cooling power expenditure is considerably reduced. Jet augmented cooling is likewise currently under investigation in an effort to realize fully any of its advantages.

Power Brake Valves

By E. F. LOWEKE
Hayes Industries, Inc.

CONSIDERABLE development in power brake valves has been in progress for the last couple of years. The greatest attention has been focused on smooth, rapid response, or the time lag between the depression of the foot pedal and the sensation of braking effort at the wheel.

Hayes Industries, Inc., as manufacturers of expander tube brakes, naturally became interested in the problem and developed the Dynaflo power brake valve, shown diagrammatically in Fig. 3. Our development program centered itself on the design of a valve which incorporated the idea of a delayed load feel. The broad idea of this principle was not new, having been disclosed in air valve patents. Air is a highly-compressible medium—the displacement or volume varying with the pressure; whereas with liquids or oils, the displacement would be constant unless special means were provided to vary the displacement. To obtain a delayed load feel with oil, a displacement chamber backed up by the load feel piston was provided. This chamber is in restricted communication with the valve brake chamber through a choke.

When the inlet valve is opened, pressure is developed in the brake chamber capable of providing a high initial accelerating force to the fluid, sufficient to overcome the head loss of the high velocity of the fluid surging through the tube line to the brakes. As yet, no pressure is felt on the load feel piston, because the fluid in the brake chamber of the valve must pass through the choke into the displacement chamber backed up by the load feel piston. With the displacement taken up, the load feel piston abuts the connecting link which reacts against the spring load to balance the input force regulating the braking pressure.

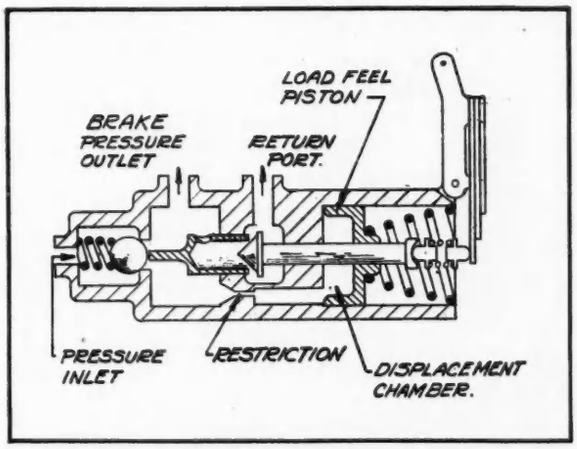

Fig. 3—Diagrammatic layout of Hayes "Dynaflo" valve showing the principle of delayed load feel for non-compressible fluids.

Commercially, the choke diameter is not critical. However, if there should be an extreme difference in the brake displacement or in the head loss of the brake line, the choke can be changed easily to meet the conditions. Other variables in the installation which influence valve performance are the variation in the brake return spring loads and the inertia of the braking members of the different type brakes.

Earlier work indicated that an unbalanced valve could be faster than a balanced valve. With an understanding

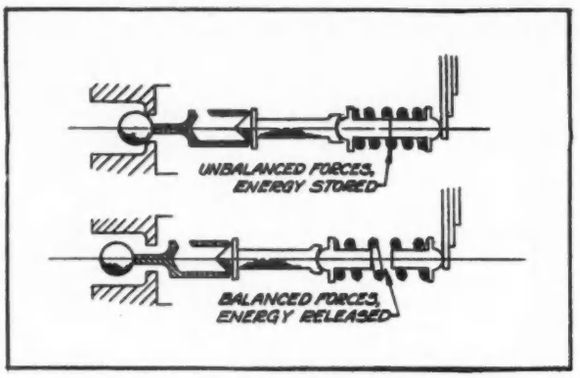

Fig. 4—Inertia balance. When equilibrium of the reactive and input forces of an unbalanced valve is established, the stored energy of a low-rate spring is released to increase the area of the valve opening.

of this, we have incorporated into the Hayes Dynaflo valve, a refinement which we term "Inertia Balance." In the closed position (Fig. 4), the valve is unbalanced by a force equal to the fluid pressure acting against the inlet valve seat area. In the initial movement of the valve operating lever, this unbalanced force is stored in a low rate spring on a telescoping connecting link. The moment the ball is cracked off the seat and flow started, the unbalanced forces are disturbed and the energy stored in the

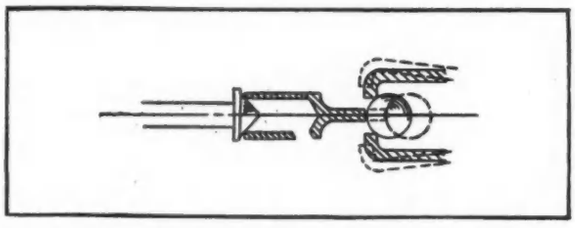

Fig. 5—Temperature compensation. By controlling relative mass of parts, area of valve opening is increased. Dotted lines indicate expanded parts.

spring is released to lift the ball high off the seat for a wide open valve. With a high-speed movie camera, we have recorded a ball lift of more than ⅛ in. which was greater than required for an area equal to the valve seat.

In the early days of power braking, it was thought that the load spring of a valve was simply a lost motion medium. From the many tests which we have conducted with springs of various rates, it cannot be emphasized too strongly that the spring rate is very important. Further, a spring with an accelerating rate is better than one with a uniform rate. For this reason, we have adopted the leaf spring which lends itself to many modifications.

Another interesting feature in the Hayes valve is the refinement of the inlet ball seat (shown in Fig. 5). When the valve is open, the fluid flows through this seat with a velocity greater than 200 fps. The wire drawing effect of the fluid under these conditions generates high local temperatures in the adjacent parts. By controlling the mass relationship between the ball and the seat so that the seat will expand away from the ball, the valve opening will increase. The pin for lifting the ball is also proportionately slenderized so as to take advantage of the greatest possible expansion of this piece. The proper expansion of these parts automatically increases the valve opening, which is the opposite effect of that which is noticeable when opening the conventional hot water faucet.

Utilization of New High Strength Aluminum Alloys

By J. F. McBREARTY
Lockheed Aircraft Corp.

A LARGE Lockheed transport airplane utilizes the new alloys and tempers of aluminum throughout the structure. The inception of design work occurred at a time when 14S sheet, 75S and R303 were not commercially available and therefore more extensive use was made of aged 24S. Furthermore, it is Lockheed's practice for corrosion prevention reasons not to utilize aged 24S in gages less than 0.032 in. due to the reduced differences in solution potential between the cladding and core, hence a considerable quantity of unaged 24S is used even in important structural applications.

Considering the wing as a representative example and a lucrative source of weight saving from the use of high strength materials, the approximate weight distribution of several materials is shown in Table I. The total weight figure given represents roughly the weight of the entire wing primary structure. Obviously, the only precise method of determining the amount of weight saved through the use of the newer materials would be to redesign the structure on the basis of the older materials and compare the weights. However, a conservative estimate has been made of the savings obtained mainly in the wing flange material. This study is based on calculations of the equivalent thickness of the lower strength material that would be required to carry the same loads. The results of this brief study are shown in Table II.

The total weight of 24S-T80, 24S-T81 and 24S-T86 material from Table I is 13,288 lb. Thus, the saving attributed to aging this material is about seven per cent which is indeed a substantial gain. The total saving breaks down to about eight or nine per cent in the compression or upper flange material, and about one or two per cent in the tension flange material. The major portion of this weight saving, as expected, occurs in the upper

Table I—Wing Material Weight Distribution—Approximate

Material Part	24ST Sheet	14ST Extr.	24ST8X Extr.	24ST80 Sheet	24ST81 Sheet	24ST86 Sheet	Misc.	Totals
Inner Wing								
Leading Edge	192	....	....	541	528	....	626	1887
Upper Flange Mat.	....	927	460	....	....	3364	60	4811
Lower Flange Mat	....	647	236	1206	278	1551	94	4012
Shear Mat.	256	....	....	....	450	1410	....	2116
Ribs	933	2206	....	716	386	315	333	4889
Trailing Edge ...	1250	....	....	....	204	348	489	2291
Misc	704	531	133	....	60	....	488	1916
Outer Wing								
Leading Edge	182	....	....	....	504	....	....	6886
Upper Flang Mat.	86	137	121	....	....	683	11	1038
Lower Flange Mat.	71	132	111	....	....	575	13	902
Shear Mat.	....	....	....	....	44	87	....	131
Ribs	100	....	....	....	....	38	138	276
Trailing Edge ...	309	....	....	....	....	....	....	309
Misc.	38	77	....	....	....	....	34	149
Totals.....	4121	4657	1061	2463	2454	8371	2286	25,413

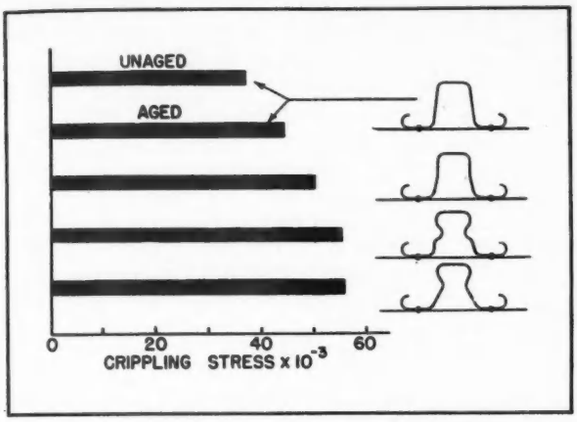

Fig. 6—Effect of aging and stiffener shape on the upper limit of column stress, using skin of 0.064 in. clad 24ST1 and stiffener of 0.072 in. clad 24ST6.

surface structure where the critical loads are compression, and such savings are not obtained solely by the simple expedient of aging 24S stiffeners or substituting a high strength material. To develop the higher allowable stresses attendant with these savings, new phenomena appear and new and different modes of failure must be prevented. A 24ST stiffener developing, say, 35,000 psi may develop but very little more when made from aged 24S or from 75S due to a collapsing, twisting or local column type of failure at 36,000 psi. Thus, in order to exploit the inherently higher physicals, special precautions and techniques must be employed to postpone these added modes of failure.

This is illustrated by Fig. 6 which shows the upper limit of the column stress (crippling cut-off stress) for a particular weight stiffener. This particular stiffener was improved only about 19 per cent by artificial aging because the failure was due to collapse of the walls. While the unaged stiffener also failed in this manner, the fact remains that the higher yield strength was not exploited. The addition of beads or creases, much the same as those found necessary in high strength steel members, delayed the failure of the walls until the full strength of the corners was reached, resulting in an improvement over the original unaged section of 50 per cent.

The wing weight saving according to the use of the high strength tempers of aluminum alloy in this Lockheed design has been variously estimated from the conservative figure of 920 lb. up to 2500 lb., and comparable savings have been made in the fuselage and tail structure. The total saving for the complete airplane is estimated to lie between 1500 and 4000 lb. When it is realized that this saving may represent 10 to 20 per cent of the payload on long range flights, the economic importance of the new high strength aluminum alloys to the aircraft industry can be more fully appreciated.

Table II—Weight Saving in Inner and Outer Wings

	Weight Saving (lb)
Inner Wing	
Upper Surface Flange Material	
Stringers 0.102 24ST86 to 0.119 24ST6 (16.7%)	316
Skin 0.081 24ST86 to 0.091 24ST6 (12.1%)	139
Lower Surface Flange Material	
Stringers (16.7%)	84
Skin (12.1%)	88
Shear Material—No change assumed	8
Tension Material (Ribs, etc.)	
24ST86 to 24ST6	9
24ST81 to 24ST1	19
24ST80 to 24ST0	50
Miscellaneous (Leading Edge, Trailing Edge, etc.)	
24ST81 to 24ST1	32
Outer Wing	
Upper and Lower Flange Material	
Stringers	104
Skin	67
Tension Material (Ribs, etc.)	
24ST86 to 24ST6	1
Miscellaneous (Leading Edge, Trailing Edge, etc.)	
24ST81 to 24ST1	11
Total Saving per Airplane (Wing Alone)	920

An Electrical Model for the Investigation of Crankshaft Torsional Vibrations in An In-Line Engine

Allison Division, General Motors Corp.
By HUGH B. STEWART

AN ELECTRICAL model has been developed at the Allison Division of General Motors to simplify the study of torsional vibration of in-line engines. In a relatively short time, it is possible with this model to determine the natural frequencies and relative amplitudes of vibration for an engine system. The effect of changing the rigidity of

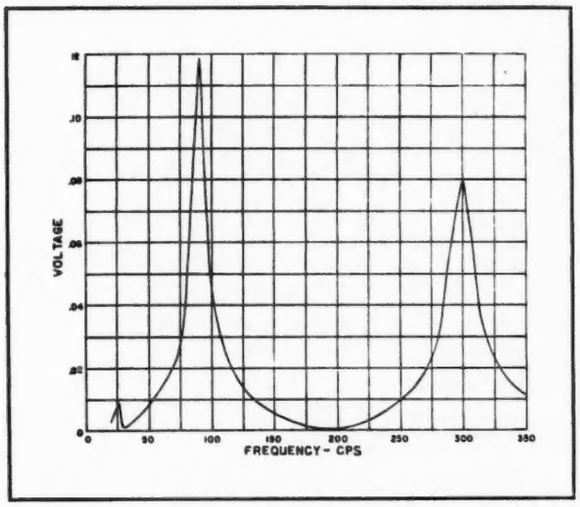

Fig. 7—Voltage resonance curve obtained from the electrical model.

inertia of various elements can be easily and quickly investigated. By adding a damping factor to the system, the absolute amplitudes of vibration can be determined with the model. Provisions are made to study the effect of various firing orders on the vibration characteristics. The torque into any part of the crankshaft or to the propeller can be found, and the effectiveness of different pendulum damper tunings as well as the pendulum bob amplitudes can be determined.

The electrical model is based on certain fundamental analogies between mechanical and electrical oscillating systems. The analogy is most apparent for the case of an electrical circuit consisting of a condenser and an inductance and a mechanical system consisting of an inertia and a rigidity element. If certain relations are established between the electrical and mechanical units, the resonance characteristics of the two systems will be similar. In fact, it is possible to determine completely

Table III

Mode	Calculated Frequency (cycles per sec)	Model Frequency (cycles per sec)
1	27.4	26.3
2	92.5	91.5
3	301.0	300.0

the vibration characteristics of the mechanical system by measuring the voltages across the elements of the electrical circuit. The procedure which has been used in the calculation of the natural frequencies and relative amplitudes of the system, is the electrical analogue of the Holzer method.

Fig. 7 illustrates the voltage resonance curve of the model where a constant current input is supplied to the rear of the crankshaft and the voltage output is measured at the same position. Fig. 8 shows the relative vibration amplitudes along the crankshaft system as obtained from the electrical circuit. Since the resonance frequencies and the relative amplitudes of the system at resonance are independent of the position of current application, any convenient position can be chosen to apply the current to determine these values. Table III shows the resonance frequencies obtained from the electrical model as compared to the calculated values. The second and third are the important modes of vibration in the engine. The frequency accuracy of the electrical model in the important range of frequencies is found to be approximately one per

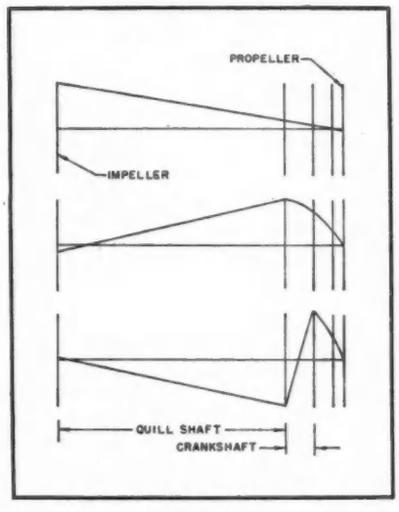

Fig. 8 — Relative amplitudes along the crankshaft system for the first three modes of vibration, as obtained from the electrical circuit.

cent. For measuring amplitudes, it is found that the mean deviation of the measured values from the calculated values is less than two per cent, while the maximum deviation is about five per cent.

A hydraulic damper is used in the Allison engine to dissipate the energy in the second mode resonance. The friction is applied between the rear of the crankshaft and the supercharger impeller. The optimum value of damping can be determined by means of the electrical model. Hydraulic dampers having different characteristics have been calibrated on a special machine which makes it possible to assign a particular damping coefficient to each damper. The appropriate resistance corresponding to the damping coefficient is then shunted across the quill shaft inductance. Fig. 9 illustrates some voltage resonance curves measured at the rear of the crankshaft when damping coefficients of 214, 294, 588, and 1176 lb-in.-sec were applied at the hydraulic damper position.

In the particular example discussed here, the propeller has been considered a pure inertia element. Actually the propeller has its own modes of vibration, and when combined with the crankshaft system will generally shift the resonance frequencies and create new resonances. By experimentally determining the effective inertia or dynamic modulus of the propeller, the inertia of the propeller can

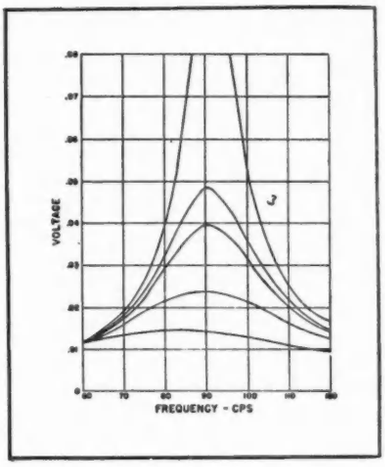

Fig. 9—Resonance curves for different damping coefficients across the quill shaft.

be corrected in the model to the effective inertia. In practical cases, it has been found that the propeller can usually be considered as a pure inertia, particularly in engines incorporating flexible extension shafts between the crankshaft and the propeller.

In general, good agreement between engine results and the electrical model has been experienced, thus making the model a valuable instrument.

Weight Reduction of Aircraft Braking System Through the Use of Reverse Thrust Propellers

TESTS were conducted on a B-32 airplane at Tarrant Field Fort Worth, Texas by CVAC personnel and the co-authors. The B-32 used has a normal gross weight of 100,000 lb, but the tests were conducted at an average gross weight of 92,000 lb with a wing loading of 65 psf. The plane was powered by four Wright R-3350 engines, each having a take-off rating of 2200 hp at 2800 rpm. The engines were equipped with Curtiss Electric four-blade, 16 ft 8 in. diameter, reversible, full feathering, constant-speed propellers, provided with automatic synchronization control in the forward pitch range.

A total of 70 landings and taxi runs were made with various combinations of wheel brakes and reversed propellers. Several runs were made for each condition to compensate for variations in pilot technique and instrumentation. The comparative results of these tests are shown in Fig. 10. It was found that the best operating procedure for a smooth, even stop was to use two reversed propellers at fairly low engine powers and then gradually apply wheel brakes until moderate braking was being used at the end of the run. Assuming a desired deceleration of five ft per sec^2, the landing distance would be reduced to approximately 2220 ft. If this technique were followed, the wheel brakes would absorb 14,280,000 ft-lb per sq-in. of brake area for the 50 per cent brakes; an emergency loading so low that these brakes would have an extremely long life and consequently low maintenance costs. This technique represents a minimum use of wheel and propeller braking and results in a satisfactory stopping distance and a longer tire life. Also, no emergency wheel brake system is required as the ab-

sence of reverse thrust from both pairs of propellers, plus the failure of the main braking system, is a more remote possibility than the failure of both normal and emergency braking systems on an airplane without reverse pitch propellers. Short emergency stops within twelve airplane lengths can be made from 100 mph with four engines reversed with power plus brakes.

The use of four reversible propellers and elimination of one-half the wheel brake capacity on the B-32 saved approximately 407 lb (47.8 per cent of the wheel brake system weight). One airline estimates a saving of $30.00 per pound saved per airplane per year. For a relatively small fleet of 20 airplanes, the maximum weight reduction shown here would mean an annual monetary saving of $244,200.

Brake dynamometer tests have conservatively shown that brakes of 50 per cent capacity have emergency capacity to stop the B-32 airplane at 100,000 lb gross weight in excess of 20 landings without the use of reverse pitch propellers. Therefore, brake capacities may be cut in half and emergency brake systems may be eliminated on both two- and four-engined airplanes by the use of reverse pitch propellers. This system also permits the application of greater wheel brake torques at high initial landing speed without skidding the tires, due to reduced wing lift resulting from the spoiling effect of the reversed propellers. To obtain the shortest run possible, it is necessary that the reverse pitch mechanism be actuated immediately upon ground contact and that full power be applied as soon as possible and held for the duration of the run. In order to eliminate control surface buffeting induced by reverse thrust operation with high power, it is very desirable that positive control surface locks be installed, designed to engage at any position and preferably be operated by a single control.

It was found that taxiing without brakes, using normal and reverse propeller thrust alone, is adequate, but power steering is desirable on large airplanes to simplify pilot technique. Reverse-sense throttles should also be used when possible.

Engine cooling was found satisfactory with either inboard or outboard propellers reversed for taxi periods less than twelve minutes endurance, with an outside air temperature of 85 F. The tests also indicated no tendency for engines operating reversed propellers to overheat in normal reverse thrust landings.

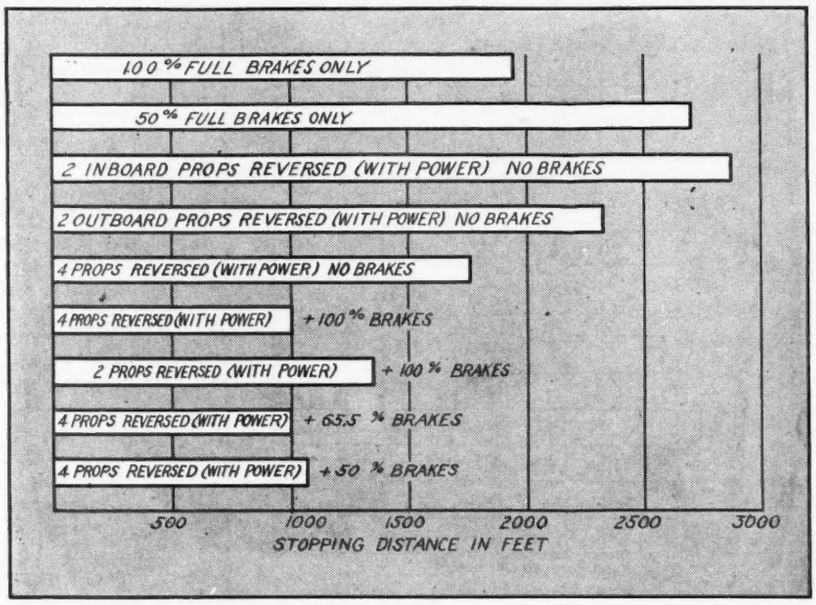
100 % FULL BRAKES ONLY
50 % FULL BRAKES ONLY
2 INBOARD PROPS REVERSED (WITH POWER) NO BRAKES
2 OUTBOARD PROPS REVERSED (WITH POWER) NO BRAKES
4 PROPS REVERSED (WITH POWER) NO BRAKES
4 PROPS REVERSED (WITH POWER) + 100 % BRAKES
2 PROPS REVERSED (WITH POWER) + 100 % BRAKES
4 PROPS REVERSED (WITH POWER) + 65.5 % BRAKES
4 PROPS REVERSED (WITH POWER) + 50 % BRAKES
500
1000
1500
2000
2500
3000
STOPPING DISTANCE IN FEET

Fig. 10—Comparative stopping distances of a B-32 airplane, using various combinations of brakes and reverse thrust propellers. 100 per cent brakes are 20 by 2¾ in. dual duplex expander tube brakes with 2765 sq-in. braking surface. 65.5 per cent brakes are 18 by 4 in. dual expander tube brakes with 1810 sq-in. braking surface. 50 per cent brakes are 20 by 2¾ in. single duplex brakes.

Effect of Engine Exhaust Pressure on the Performance of Compressor-Engine-Turbine

By C. FAYETTE TAYLOR
Massachusetts Institute of Technology

RECENT improvements in the efficiency of centrifugal compressors and exhaust turbines have stimulated interest in the possibility of the compressor-engine-turbine combination for aircraft in which the turbine is geared to the engine crankshaft. The object of the work reported in this paper was to determine the effect of variations in the engine exhaust pressure on the performance of such units at various altitudes.

The experimental part of the investigation consisted of measurements of power, fuel consumption and exhaust-temperature at various inlet and exhaust pressures. The engine used consisted of a Lycoming liquid-cooled aircraft-type cylinder, mounted on a special single-cylinder crankcase. The test results were used to compute the overall performance of compressor-engine-turbine combinations at various altitudes and with various inlet and exhaust pressures. In addition to the computations based on engine tests, a series of computations was made based on the thermodynamic charts for fuel-air mixture at equilibrium. These computations were made for conditions

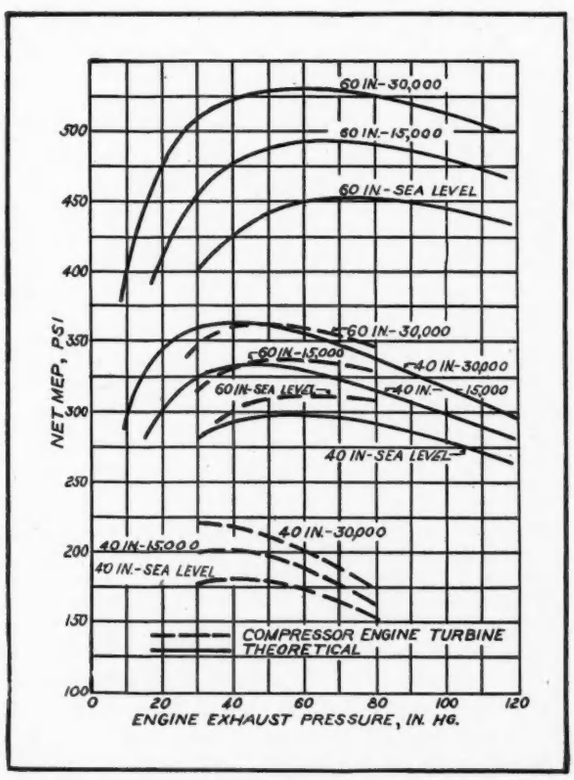

Fig. 11—Relationship between net mep and exhaust pressure at various altitudes and manifold pressures.

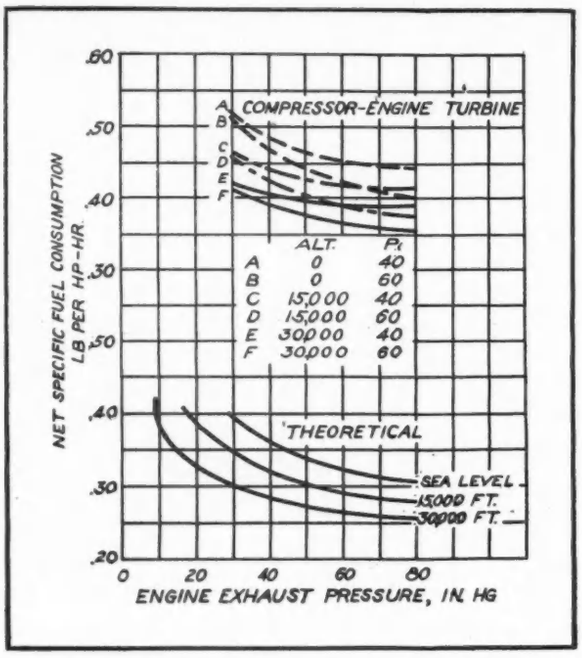

Fig. 12—Relationship between net specific fuel consumption and engine exhaust pressure at various altitudes and manifold pressures.

corresponding to those covered for the compressor-engine-turbine combination.

Fig. 11 shows net mean effective pressures of the unit as a function of exhaust pressure, inlet pressure and altitude for both the compressor-engine-turbine combination and for comparable theoretical cycles. It is interesting to note that both sets of curves show maximum mep very near the point where the engine exhaust and inlet pressures are equal. Fig. 12 shows net specific fuel consumption, that is, the fuel consumed per hp-hr of the whole system. The lowest specific fuel consumption occurs at a higher value of the exhaust than that for maximum maximum mep in every case.

Compared with the conventional aircraft engine, high specific output and low specific fuel consumption can be obtained with the engine-compressor-turbine combination, particularly at high altitudes. Under the conditions assumed in this work, the ratio of engine exhaust pressure to engine inlet pressure should be in the range of 0.70 to 1.1 for maximum net output. For lowest net fuel consumption, the ratio of exhaust pressure to inlet pressure should be in the range of 1.4 to 2.0. Theoretical cycles show the same general trends with varying exhaust pressure, as the compressor-engine-turbine combination. However, the ratios of exhaust to inlet pressure for maximum output and for lowest specific consumption are somewhat higher.

In the limited amount of running involved in the engine performance tests, there was no indication that high exhaust pressures imposed undue mechanical or thermal stresses on the engine.

Factors in Aeration and Deaeration of Aircraft Engine Oil

By W. L. WEEKS
Wright Aeronautical Corp.

AERATION of engine oil in the airplane powerplant has been a recognized source of trouble for the past four or five years. The frequency of trouble cases has increased as engines have increased in size, with their oil flow rate stepped up proportionately.

The responsibility of scavenge pumps, in their excess capacity, for the unsatisfactory separation of entrained air at the tank is not established. We have sampled oil continuously from the bottom of engine sumps half an inch below the surface of oil flowing into the scavenge pumps on several engine models. The air content of sump mixture, before being scavenged, varied between 6 and 20 per cent. This is not surprising, for high power reduction gears, two-speed superchargers and the expanded list of engine-driven accessories involve the use of a lot of cog wheels. A late engine model has a total of 110 gears of which various groups engage their teeth at velocities of 5500, 8200 and 12,200 fpm. The tip speed of oil pump gears is seldom more than 1300 fpm, so even though these pumps handle, positively, large air volumes it is likely that the air is not torn into such fine bits so that in the spume from gears meshing at four to nine times that speed. Since gears are likely to remain the means of transmitting rotative motion in reciprocating and other type engines, we must find ways of deaerating the emulsion.

The nature of the emulsion, as to fineness of division of its air content, is a factor of basic importance and difficult to evaluate. When engine oil has had a few hours of service it holds enough carbon to make the accurate reading of settling levels practically impossible. After some experimentation we accepted, temporarily, a rather unscientific method of gaging the final reluctancy of settling. In watching a sample of scavenge oil taken by overflowing a graduate held under the return line at the tank on a test stand, we struck on a rough criterion. As coarse foam collects and disperses on the surface and the fine bubbles continue to rise, but at a progressively slowed rate, the total foam mass shrinks to expose the oil surface. We arbitrarily set a diameter of clear oil surface of 3/10 in. and timed the settling to that degree of completion. Such a gaging method is crude, having an error as to initial and final quantities of finely divided air. It did, however, convince us that oil/air mixtures

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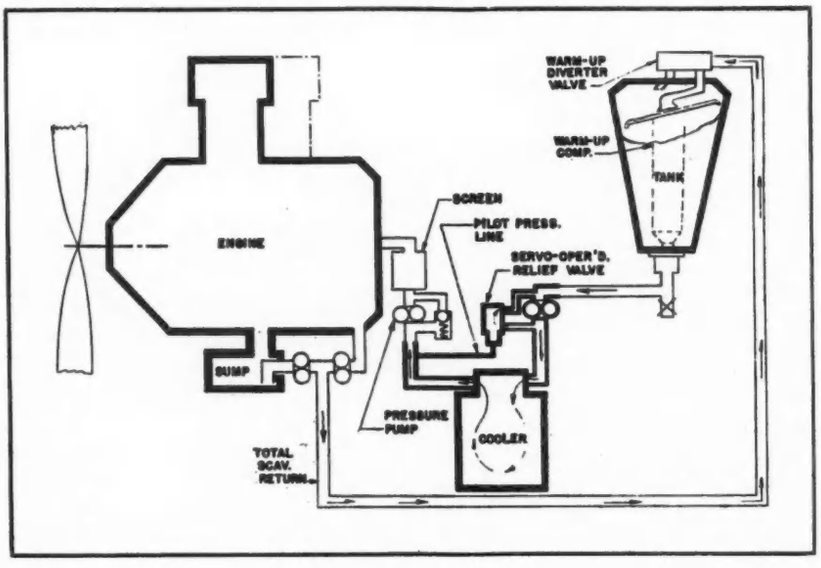

Fig. 13—Schematic diagram of the Wright "hot tank" airplane oil system.

Human Engineering

Necessary for Further Mass Production Progress

By Henry Ford II

President,
Ford Motor Co.

THERE is a whole vast area in which we are only beginning to make significant progress —what we might call the field of human engineering. Machines alone do not give us mass production. Mass production is achieved by both machines and men. And while we have gone a very long way toward perfecting our mechanical operations we have not successfully written into our equations whatever complex factor represents Man, the human element. If we can solve the problem of human relations in industrial production, we can make as much progress toward lower costs during the next 10 years as we made during the past quarter century through the development of the machinery of mass production.

In approaching the complex problems of human relations, management must take the initiative for developing the relationships between labor and management. Labor has a great opportunity to achieve stature through assuming greater responsibility. But I consider that management is in charge, that management must manage, and that the test of management is whether or not it succeeds.

Mass production did not invent the human equation, but it did alter it in a number of important respects which we may have been slow in taking into account. Under mass production large numbers of people flocked to the assembly line, each to perform a highly specialized routine duty. Mass production produced great concentrations of people, and a problem of communicating with them. It produced the difficult problem of specialization, where the human being loses sight of the social usefulness of what he does.

How badly we have taken the human factor into account is indicated by many statistics. The Department of Labor shows that a total of 216,000,000 man-days were lost between 1927 and 1941 as a result of strikes alone. This idleness was expensive, to the strikers, to the companies and to the nation, and that cost was part of the nation's cost of production. Consider how many thousands of automobiles, radios, refrigerators and other useful and needed products could have been manufactured with 216,000,000 man-days of labor. Or, to put it in another way, consider how much lower would have been the cost of the things that were manufactured if production had not had to absorb the expense of these work-stoppages. Furthermore, when a production line stops, the jobs and purchasing power of hundreds of thousands of people in related businesses all over the country are affected.

Strikes are by no means the only measure of lost time. That loss, indeed, is only a fraction of the time lost through industrial inefficiency and through mass unemployment. Costs are also closely related to the productivity of the individual American worker. Recent statistics on productivity are confusing because of the factor of war. War necessarily brought into industry a great many less experienced men and women. The armed forces took away a great many skilled workers.

Other prewar mass production industries have found, as has the Ford Motor Co., that even after allowance for these unusual circumstances the recent record of productivity is not encouraging. Detailed records are kept of the time it takes to perform various operations. The following examples are in every way comparable, that is, the operations have not been changed so that more time should be allocated to their performance.

One group of operations which took 96 minutes in 1940 took 128 minutes five years later. Another group which took 1188 minutes in 1940 took, five years later, a total of 1943 minutes to perform. A third group took 28 minutes in 1940 and 49 minutes five years later. On the whole, productivity per worker in Ford plants declined more than 34 per cent during the war period.

The solution to these problems in human relations must be found through a closer understanding between management and labor. If we cannot succeed by cooperation, it doesn't seem likely that we can succeed by any exercise of force. We cannot, for example, expect legislation to solve our problems. Laws which seek to force large groups of Americans to do what they believe is unfair and against their best interests are not likely to succeed. In fact, such legislation can lead to exaggeration of the very problem it is designed to

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This article consists of extracts from the address, "The Challenge of Human Engineering," which was given Jan. 9 by Mr. Ford at the annual meeting of the Society of Automotive Engineers in Detroit.

"Ability to Pay" Theory

Its effects on industry if adopted, as presented in a letter to President Truman by the A.A.P.M.

THE following is the text of a letter sent to President Truman by Frank Rising, general manager of Automotive & Aviation Parts Manufacturers, Inc., in which he discusses the effects of the "ability to pay" theory upon industry if it should be adopted:

January 2, 1946

Hon. Harry S. Truman
The White House
Washington, D. C.

My dear Mr. President:

This letter is written to discuss the situation arising from the General Motors' strike and subsequent appointment of government panels. It is written on behalf of the automotive parts plants, of which 403 are members of the undersigned association.

Our companies make the wheels, carburetors, axles, valves, piston rings, spark plugs, radiators, and all other constituent parts of automobiles, trucks, and tractors, and sell these parts to General Motors, Chrysler, Ford, and all the other vehicle manufacturers. In normal times the parts companies employ about 350,000 persons, and the factories are situated in some 30 states. Most of these companies are relatively small in size, the majority having less than 600 employees each. Our smallest member employs 37 persons.

We have been proud of the record we made in war production, and are very anxious to get back to full-speed peacetime work. During these recent weeks we all have been gravely worried by the course of affairs, and we believe that you will welcome a brief exposition of our views at this time.

Our manufacturing employers accept and adhere to the law of the land which provides for the right of American labor to bargain collectively through its own representatives. The parts companies have contracts with many unions affiliated with the AFL and CIO, and there are current some 250 contracts with one large union alone—the UAW-CIO. Yet today we feel that these relationships are endangered by the policy which is being pursued by some of the unions and which is approved to some extent by your fact-finding panels.

We believe that the position taken by General Motors on the question of "ability to pay" is fair, straightforward, and logical, and that the decision to be made by you and the people of the country, and by their Congress, is of utmost importance. The gravity of the question as it concerns the public welfare can hardly be exaggerated.

The "ability to pay" theory, if adopted, may have very serious destructive effects on our companies. If this principle is established, a General Motors or a U. S. Steel would inevitably drain off from other shops and factories the cream of industrial labor, and in the end there would be but one big company in each industry.

We believe that it is recognized by you, Mr. President, but perhaps not by the public generally, that even in good years there are many sound and going companies which do not make a profit. This is true for a variety of reasons, and is not concerned with the relative efficiency of management. We think it should be pointed out, too, that wage scales seldom are immediately affected by temporary recession in business.

In this connection, we think it is fair to recall your statement that, after all, wages are paid out of earnings and that therefore earnings must be considered in connection with wages. May we respectfully point out that wages can be paid entirely out of earnings only when there are profits, and that not infrequently the company draws on capital or surplus or previous earnings, so that the period of unprofitable business will not cause a reduction in wage levels.

It should be remembered that all of the present discussion takes place in days which are very unusual. We should pause to calculate the effect of "ability to pay" in normal times, when fluctuations in trade bring slightly more sales and profits in one year, slightly less the next. These periods, as noted above, ordinarily witness no serious change in the wage scales, but under "ability to pay" a continuous and disturbing instability in wage rates would result.

It seems to us that there are only two courses which the union policy may take in the future, if the "ability to pay" theory is adopted. These courses obviously are:

1. After the setting of the wage scale for a General Motors, all other companies would be expected to match those rates despite any relative inability to pay, or

2. The "ability to pay" theory would be applied, resulting in a variation of wage rates of incalculable complexity.

From experience we know that the union adheres to the theory that the same wage for a designated classification should be paid by all companies in the same industry. The War Labor Board followed this policy, with allowance for geographical and inter-industry differentials.

Consequently, it is to be expected that the union would insist upon "ability to pay" being used for the largest and most successful company in each industry, and "equal pay for equal work" for all other companies. This, we feel, would most certainly result in the speedy disruption of the entire industrial economy.

We feel sure, Mr. President, that you want to help the individual to remain free to exercise his ingenuity and ability in the traditional American fashion, under a system of law and justice. That is what we want to maintain.

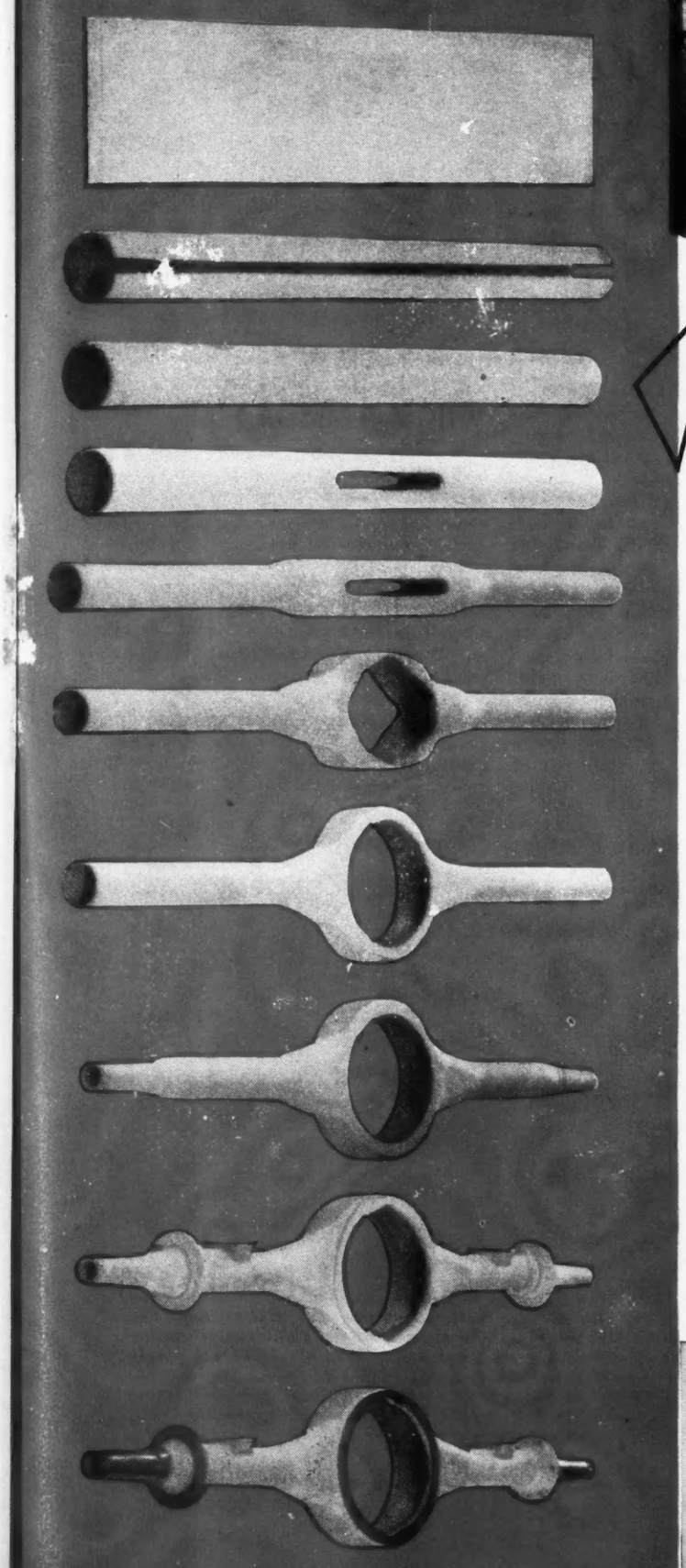
We hope most earnestly that in the light of more complete facts you will recognize the fairness of these statements, and we further hope that you will call upon the Congress to undertake restoration of industrial peace through a revision of labor law and provision for administration on a basis of equity and justice.

We feel that this communication to you, and the subject matter which it discusses, is of such importance as to warrant our bringing it to the attention of the Congressmen and Senators and others interested in this momentous public issue, and we trust that we may be honored with your views.

In closing, may we offer our help in any way in which you think it might be used, in finding fair and reasonable solution to our common problems.

Most respectfully,
Automotive & Aviation Parts Manufacturers, Inc.
FRANK RISING
General Manager

Inland plates, 17⅛" x 68" x .335" thick, are rolled, formed and forged into truck housings in these successive steps.



THESE Nine Operations Prove the Quality of Inland Steel

In Buchanan, Mich., the Clark Equipment Co. produces one-piece tubular forged truck housings—a great contribution to the truck industry, and the proof of the uniformity and quality of steel from Inland.

Many thousands of these housings are made from Inland plates, which are first rolled into tubes, welded by the multi arc atomic hydrogen welding process, and formed by severe cold working as well as hot working operations. The housings are then heat treated, developing a higher yield point, and higher fatigue properties. These housings have great strength commensurate with durability and toughness.

It takes uniform high quality steel to make truck housings this modern Clark way. That is why Inland steel was chosen—steel that is controlled step by step, from ore mines to finished product, by skilled technicians who daily make hundreds of tests and inspections. This job of checking and rechecking is so thorough that you can always depend on Inland Steel.

We invite you to let our Inland men help you select the right steel for finer, stronger products and more economical fabrication.

INLAND STEEL COMPANY, 38 S. Dearborn St., Chicago 3, Ill. *Sales Offices:* Cincinnati, Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul. *Principal Products:* Sheets, Strip, Tin Plate, Bars, Plates, Floor Plate, Structurals, Piling, Rails, Track Accessories, Reinforcing Bars.

INLAND STEEL

Some Automobile Factories Slowly Approaching Volume Production

Studebaker and Willys Now in Production, G.M. Still Closed by Strike, Packard and Nash by Shortage of Parts

Following holiday shutdowns, the automobile industry has settled down again on a slow but steady pull upgrade towards something resembling volume production. The 1946 production parade was joined by two companies—Studebaker and Willys—which had not been running during the last months of last year, but on the debit side of the ledger, General Motors, Packard, and Nash, all of which had turned out cars in 1945, were missing. Only one, G.M., was closed because of a strike of its own, but the other two were just as effectively stopped by shortages due to strikes at other plants.

Of the companies operating at the first of the year, Ford appears to be in the best condition to keep going in the event of a prolonged continuation of the glass strike and a possible steel stoppage. The company has its own glass plant at St. Paul, which can supply about a third of the glass needed for current production rates. In addition the company is buying glass outside and is laminating it at the Rouge plant. However, until the glass strike is settled, there appears to be little hope for increasing production substantially. Ford also has its own steel mill, which would help out in limited production, but would not permit any sizeable output. Production of Ford cars now is around 1000 to 1100 a day. Mercury output is close to 175 daily, and Lincolns are coming off the lines at the rate of 30 to 40 a day making a combined total of about 1200 to 1300 cars. Truck and commercial car production is approximately 1000 a day.

Chrysler Corporation, after a slow start getting into production, now is reported to be putting out a total of around 1000 cars a day by all divisions. Hudson Motor Car Co., which got away to an early start last year, only to be tied up by strikes in its own and supplier plants, is reported to be turning out between 150 and 200 cars a day, a rate not greatly in excess of that prevailing last October. It is likely that if the glass strike continues very long, Hudson will be forced to close. Studebaker Corporation, which has been delayed for 13 weeks because of the Warner Gear strike, finally got underway Jan. 2. Since the period of enforced idleness had been used to build up inventories of parts and sub-assemblies, production there is climbing rapidly and is expected to reach 400 daily yet this month. Nash and Packard both were forced to close during the dying days of 1945 because of shortages of parts. In the case of Nash, glass was the principal shortage. Packard attributed its shutdown to a specific scarcity of transmission bushings and crankshaft and connecting rod bearings. The latter two items were furnished by Moraine Products Div. of G.M. While there are four alternate sources of supply for these bearings, at the time of the shutdown three were strike-bound and the fourth was so loaded with prior work that it could not take the Packard business. The company also had been plagued with shortage of other parts since it began production. One unit of Briggs Mfg. Co., which makes bodies for Packard, also closed the week before Christmas and had not reopened because of the glass shortage.

How long automobile companies which are dependent on General Motors for parts can continue to operate is uncertain. It is thought that Chrysler and Studebaker, because of their late starting dates probably have a larger supply of fuel pumps, of which G.M. is the principal supplier, and glass than other companies. Ford, which buys only fuel pumps from G. M. is reported to have an alternate supply which would allow at least limited production. Packard

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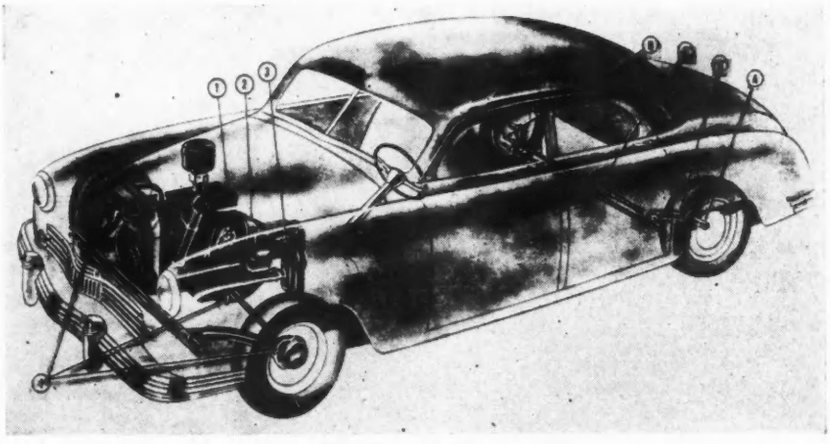
Jas. D. Mooney Elected Willys President

James D. Mooney, who resigned as a vice president and member of the board of directors and of the administration committee of General Motors Corp. Jan. 7, was elected president and chairman of the board of Willys-Overland Motors at a meeting of the board of directors held at Toledo, Ohio. He succeeds Charles E. Sorensen as president and Ward M. Canaday, who was chairman of the board for ten years.

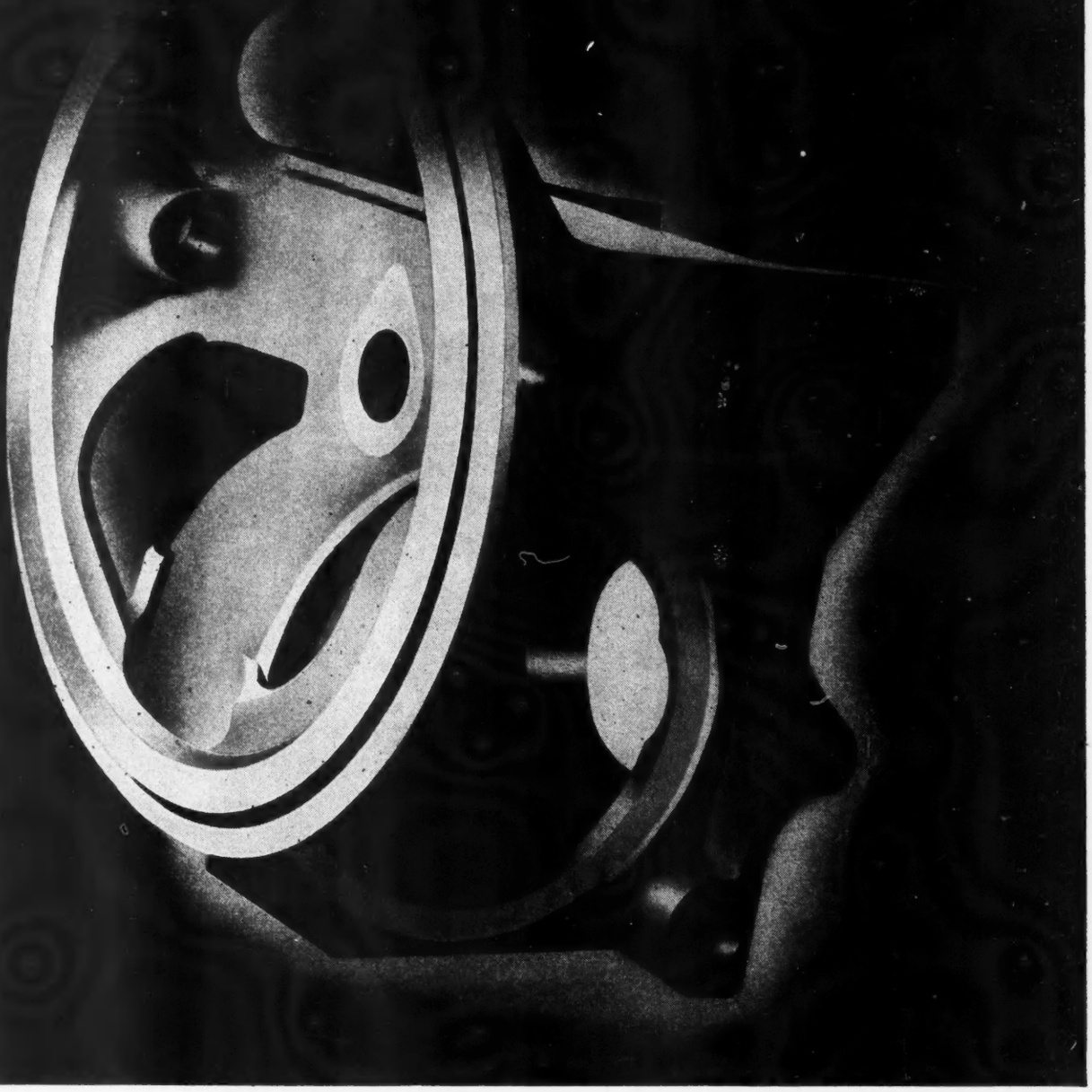
Mr. Canaday was elected to the newly-created office of chairman of the finance committee, and Mr. Sorensen, president since early 1944, was made vice chairman of the board of directors.

Kaiser Car Features "Packaged Power"



This phantom view shows the "packaged power" front-wheel drive and the "torsionetic" suspension, two of the features of the new Kaiser car. The "packaged power" assembly combines the six-cyl, 85-hp Continental engine (1), clutch (2), transmission (3) and final drive assembly (4) in a single unit which can be removed from the integral body-and-frame for service. The "torsionetic" suspension provides independent springing for each wheel through spindle (A), supporting arm (B), and torsion-bar spring (C), anchored at (D). Hydraulic shock absorbers are included in the assembly.

Molybdenum in cast iron helps foundries meet standard and special requirements consistently and economically.



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

500 Fifth Avenue • New York City

MOLY

C. A. MUSSELMAN

Willys-Overland to Build Low-Cost Passenger Car

In the annual report to stockholders of Willys-Overland Motors, Inc., Charles E. Sorensen, president, reports that the company has designed and tested a completely new low-cost passenger car. He said it embodies features and basic improvements never before offered in its price class. Sorensen also reported that Willys will build a "new and original vehicle closely related to the station wagon" which also will have unusual features. In addition, the company will offer a new light truck in four conventional body types on the same chassis, and a larger commercial chassis of heavier load capacity will follow. Details of the cars were not announced, and it is reported that public showings will not take place until April.

Jet Powered Plane Developed by Navy

The first Navy fighter plane powered exclusively by jet engines, and designed for carrier operation has been announced by the Navy Department. The new plane, designated the FD-1 Phantom, was designed and built by the McDonnell Aircraft Corp. of St. Louis.

The FD-1 has a service ceiling of well over seven miles and is the first Navy fighter to attain speeds in excess of 500 mph. Primarily designed as an interceptor, it has an extremely high rate of climb and a range of approximately 1,000 miles.

Power for the Phantom is furnished by twin axial-flow Westinghouse turbojet engines into the wing roots. The engines, which are of exclusively American design, contain no long scoops or ducts. For conditions where take-off assistance is needed, either carrier catapults or JATO units may be used.

C. A. Musselman

C. A. Musselman, 73, chairman of the board of the Chilton Company, died Jan. 3 in the Presbyterian Hospital after a protracted illness.

Originally secretary and treasurer of the publishing company in 1901, he became president of the automotive unit in 1923, and was elected president of the company in 1934, retiring from that post in June, 1945, to become chairman of the board.

Active for many years in both the automotive and publishing fields, he was a member of the Society of Automotive Engineers and had served as president of Associated Business Papers and as a member of the board of the National Publishers Association. He was also a member of the Union League, the Philadelphia County Club, and the Poor Richard Club.

Federal Machine and Welder Buys Sommer & Adams Co.

The Federal Machine and Welder Co., Warren, Ohio, has acquired full ownership of the Sommer & Adams Co., Cleveland designers and builders of a variety of special machine tools for the automotive and aviation industries.

Crosley Determined to Capture Share of Low-Cost Small Automobile Market

Crosley Motors, Inc., outgrowth of the Automobile Division of Crosley Corporation, is determined to capture its share of the low-cost small automobile market. Powel Crosley, Jr., president of the company, recently showed newsmen the new lightweight Crosley-Taylor engine and the redesigned body which the company counts on to appeal to the large segment of buyers who cannot afford one of the larger makes or who want a small, low cost, economically operated vehicle for auxiliary use or for specific purposes.

Engines for the car will be built at Cincinnati. The company is tooling for production of 20 per hour now, and this later can be increased to accommodate much greater volume. Front axles also will be made there. Crosley makes practically all of the stampings from which the engine is constructed. Body stampings are made in Indianapolis and shipped to Marion, Ind., where bodies are built and the cars assembled in the old Peerless automobile plant, which the company acquired recently. Rear axles are purchased from Spicer Mfg. Co.; Rockford Clutch Div. of Borg-Warner Corp. furnishes the clutch; steering gears come from Ross Gear and Tool Co., and the transmission is provided by Warner Gear Div. of Borg-Warner.

Initial production will start at around 125 cars a day and build up gradually as the market expands. Crosley says that if he can ultimately reach 150,000 units annually, he will be satisfied. No price has been set as yet on the car, but he promised that it will maintain the differential necessary to induce sales.

The company now is lining up dealers, and wants about 125 outlets established before March. It then plans to contact dealers already established to take on the Crosley line. Crosley strategy is to induce dealers now handling high-priced lines to take on the Crosley line as a non-competitive product. It wants to get dealers who are well-established with sales and service facilities. The objective is to get experienced dealers, rather than flighty and irresponsible opportunists who want to cash in on the postwar market.

The company also has other plans for its engine aside from its use in the automobile. Other uses are for marine applications, motor generator sets, air conditioning equipment, and for powering farm machinery. Crosley may build a farm tractor or furnish the engine for one.

Crosley Motors, Inc., is a $3.5 million corporation. This however, is the initial capital structure only, and will be expanded if and when additional capital is needed to meet expanded production, according to Mr. Crosley.

A technical description of the Crosley automobile appears on page 18 of this issue of AUTOMOTIVE *and* AVIATION INDUSTRIES.

1945 Passenger Car Production in the United States by Makes

Chrysler Corp.	
Chrysler	402
DeSoto	1,250
Dodge	2,694
Plymouth	2,568
	6,914
Ford Motor Co.	
Ford	34,713
Lincoln	568
Mercury	2,848
	38,129
General Motors Corp.	
Buick	2,481
Cadillac	1,205
Chevrolet	12,776
Oldsmobile	3,956
Pontiac	4,050
	24,468
All Others	
Hudson	4,905
Nash	6,148
Packard	2,989
Studebaker	7
Willys	None
	14,049
Total—All Makes	83,560

Smart Guy!

SMART? . . . Sure he's smart. He knows there's a lot of difference between the three FORM-A-GASKETS!

FORM-A-GASKET No. 1 (a paste) sets fast but not too fast. It dries hard but not brittle. It's a swell product for making pressure-tight, leak-proof unions even when surfaces are warped.

FORM-A-GASKET No. 2 (a paste) sets a little slower than No. 1. It dries to a tough, pliable layer into which you can push your finger nail. It resists plenty of pressure—yet disassembles easily.

AVIATION FORM-A-GASKET No. 3 (a liquid) does not dry but it sets itself into position in a short time. It will not run when heated even to 400° F. Nor will it become hard and brittle at temperatures down to 70° below zero. It's a great, all-around product!

PERMATEX COMPANY, INC.
BROOKLYN 29, N. Y., U. S. A.

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

General Motors Corp., Distribution Staff, **Norman K. Haig,** Director of Government Sales Section.

Chevrolet Motor Div., **Clinton R. Scharff,** Traffic Director, **J. E. Simons,** Regional Mgr., Great Lakes Region.

Oldsmobile Div., **W. O. Lampe,** Exec. Asst. to General Sales Mgr.

Ford Motor Co., **Logan Miller,** Gen. Supt., Ford Rouge Plant; **Dean L. Sellers,** appointed to Executive Sales Staff; **Ben R. Donaldson,** Asst. Director of Adv.: **Frank J. McGinnis,** head of Passenger Car Adv.

Chrysler Corp., Dodge Div., **L. L. Colbert,** President.

Willys - Overland, **Charles E. Schutte,** Chief Engineer, Body Div.

Mack Mfg. Co., **W. M. Walworth,** Vice-Pres. and Chief Engineer.

Federal Motor Truck, **J. Milton Shatzel,** Works Mgr.

Graham-Paige Motors Corp., **William M. Flook,** elected to Board of Directors; **Albert W. Lavers,** Chief Engineer, Farm Equip. Div.

Kaiser-Frazer Corp., **Clay P. Bedford,** Vice-Pres. in chg. of Manufacturing at Willow Run; **G. F. Petersimes,** Mfg. Mgr.; **Joseph P. Snider,** Supervisor of Traffic; **E. J. Hunt,** Mgr. of Operations, Willow Run plant; **Frederick W. Watson,** Mgr. Body Div.

Gar Wood Industries, Inc., **Edward Boehm,** Vice-Pres. and Treasurer, has been elected a director of the company.

Studebaker Export Div. of Studebaker Corp., **Ingvar E. deSherbinin,** Far Eastern Representative.

Diamond T Motor Car Co., **C. A. Tilt,** retired as President; **E. J. Bush** is his successor.

Packard Motor Car Co., **Col. Jesse G. Vincent,** elected to Board of Directors.

Consolidated Vultee Aircraft Corp., **V. C. Schorlemmer,** Vice-Pres. in chg. of finance, succeeding **Francis A. Gallery.**

United Aircraft Corp., Hamilton Standard Propellers Div., **W. T. Beebe,** Personnel Mgr.

Douglas Aircraft Co., Inc., **G. A. Huggins,** Mgr., Santa Monica Plant.

The Sperry Corp., **Capt. Thomas B. Doe,** elected President, succeeding **Thomas A. Morgan,** who becomes chairman of the board and chief executive officer.

The International Nickel Co., Inc., **W. S. Mounce,** Metallurgist, Development and Research Div.

General Electric Co., Transmitter Div., **H. M. Wales,** Sales Mgr. of Aviation Electronic Equipment.

Worthington Pump and Machinery Corp., **James C. Barnaby,** General Engineering Staff, Harrison Works as asst. Director of Research and Development.

United States Rubber Co., Gillette Tire Div., **J. J. Stephens,** Merchandise Mgr.

United States Rubber Export Co., Ltd., **L. C. Boos,** elected President and **Herbert G. Kieswetter,** Vice-Pres.

The Timken Roller Bearing Co., **Fred Reiser, Jr.,** Div. Mgr. of all Cincinnati Div. of the Company; **Harry McCool,** Sales Engineer, Steel and Tube Div.

Republic Steel Corp., Union Drawn Steel Div., **Cleo E. Gustafson,** Supt. of Gary, Ind., Plant.

Parker Appliance Co., **C. H. Wagner, Jr.,** elected Vice-Pres.

The Cleveland Graphite Bronze Co., **John W. Dixon,** Treas. and Controller in chg. of finance div.; **William G. Laffer,** Works Mgr.

Niles-Bement-Pond Co., **Richard W Banfield,** Treasurer, succeeding Everett L. **Morgan,** retired.

Jessop Steel Co., **Fred T. H. Youngman,** elected President, succeeding **R. Edson Emery,** now chairman of the board.

Westinghouse Electric Co., Pacific Coast Mfg. and Repair Div., **J. H. Cox,** engineering mgr.

Allis-Chalmers Mfg. Co., Tractor Div., **Charles N. Karr,** Sales Promotion Mgr.

Ohio Stainless Steel Co., **Allen Hurt,** Sales Mgr.

ACF-Brill Motors Co., **David H. McIlvaine,** Director of Public Relations.

Tomkins-Johnson Co., Inc., **James White,** Controller of Materials.

Ohio Rubber Co., **Brigadier General Hermon F. Safford,** elected Executive Vice-Pres.

Latrobe Electric Steel Co., **Dr. Stewart G. Fletcher,** Chief Research Metallurgist.

Greer Hydraulics, Inc., **Lt. Comdr. Julius Kendall,** Asst. to the Chief Engineer in chg. of sales, service and advertising.

American Brake Shoe Co., **Irving F. Wagner,** Vice-Pres. of Kellogg Div.

Ellinwood Industries, **Foster M. Gruber,** Administrative Asst. to Pres.; **Orrin Broberg,** Chief Eng. Marine Equipment Div.: **Colin Chambers,** Sales Mgr., Furnace Brazing and Heat Treating; **D. W. Morgeson,** Supt. of Farm Equip. Div.: **Palmer Wentworth,** Personnel Mgr. and **John H. Williams,** Project Eng., Farm Equipment Div.

The Perfex Corp., **I. G. Bohrman,** Vice-Pres. in chg. of Radiator Div.

E. A. Goddard, Gen. Mgr., Goddard and Goddard Co., elected Pres. and **R. G. Michell,** Pres., Eclipse Counterbore Co., elected Vice-Pres. of Cutting Tool Mfg. Assoc.

The Bassick Co., **George L. Meyer, Jr.,** elected Pres., succeeding **W. A. Rose,** resigned.

Surface Combustion Corp., **O. R. Lutz,** Service Engineer on Janitrol gas-fired heating equipment.

Ansul Chemical Co., **Robert C. Hood,** Secretary.

Hammel-Dahl Co., **Bruce A. Irwin,** Sales Mgr.

B-W Superchargers will Move to Cleveland

Operations of B-W Superchargers, Inc., a Borg-Warner subsidiary, will be moved from Milwaukee to Cleveland where facilities of the Pesco Products Co. will be made available for continuing production. The Milwaukee organization will continue to operate under its present identity. The transfer probably will take place late in January.

B-W Superchargers manufactures compressors and superchargers for internal combustion engines.

A. F. Davis Undergraduate Welding Award Program

To stimulate undergraduate interest in welding, funds have been donated by A. F. Davis, of the Lincoln Electric Co., for the A. F. Davis Undergraduate Welding Award, which will consist of four cash prizes totaling $700 to be presented annually to authors and publications for the best and second best articles on welding published in undergraduate magazines or papers during the preceding year. Any undergraduate of a college, university, or institute of technology in the United States or Canada is eligible, but the paper must be published in an undergraduate publication. Judges selected by the Educational Committee of the American Welding Society will select the winning paper in July of each year on the basis of originality of the paper and thoroughness in which the subject is covered. The awards will be as follows: Two hundred dollars each to the author of the best paper and to the publication in which it appears, and $150 each to the author and the publication for the second best paper.

Presentation of the first A. F. Davis Undergraduate Welding Awards for papers published between now and July 1, 1946, will be made at the next annual meeting in October, 1946.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE AND AVIATION INDUSTRIES**

The upward trend of general business activity continued as the year-end approached. The *New York Times* index for the week ended Dec. 22 stands at 131.1, as compared with 131.0 for the preceding week and 142.4 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended Dec. 22 were 14 per cent greater than those in the corresponding period in 1944. The total for the year to that date was 11 per cent above the comparable 1944 figure.

Electric power production during the same week was further increased. The output was 8.2 per cent below that a year earlier, as against a comparable decline of 9.0 per cent in the preceding week.

Railway freight loadings during the week ended Dec. 22 totaled 688,300 cars, 10.8 per cent below the figure for the preceding week and 9.8 per cent below that for the corresponding period in 1944.

Crude oil production in the same week averaged 4,479,650 barrels daily, 35,050 barrels below the preceding rate and 5 per cent less than the corresponding quantity a year earlier.

Bituminous coal and lignite production during the week ended Dec. 22 totaled 11,100,000 net tons, 10.2 per cent below the preceding weekly output. Total production for the year to that date was 7.5 per cent less than the comparable amount in 1944.

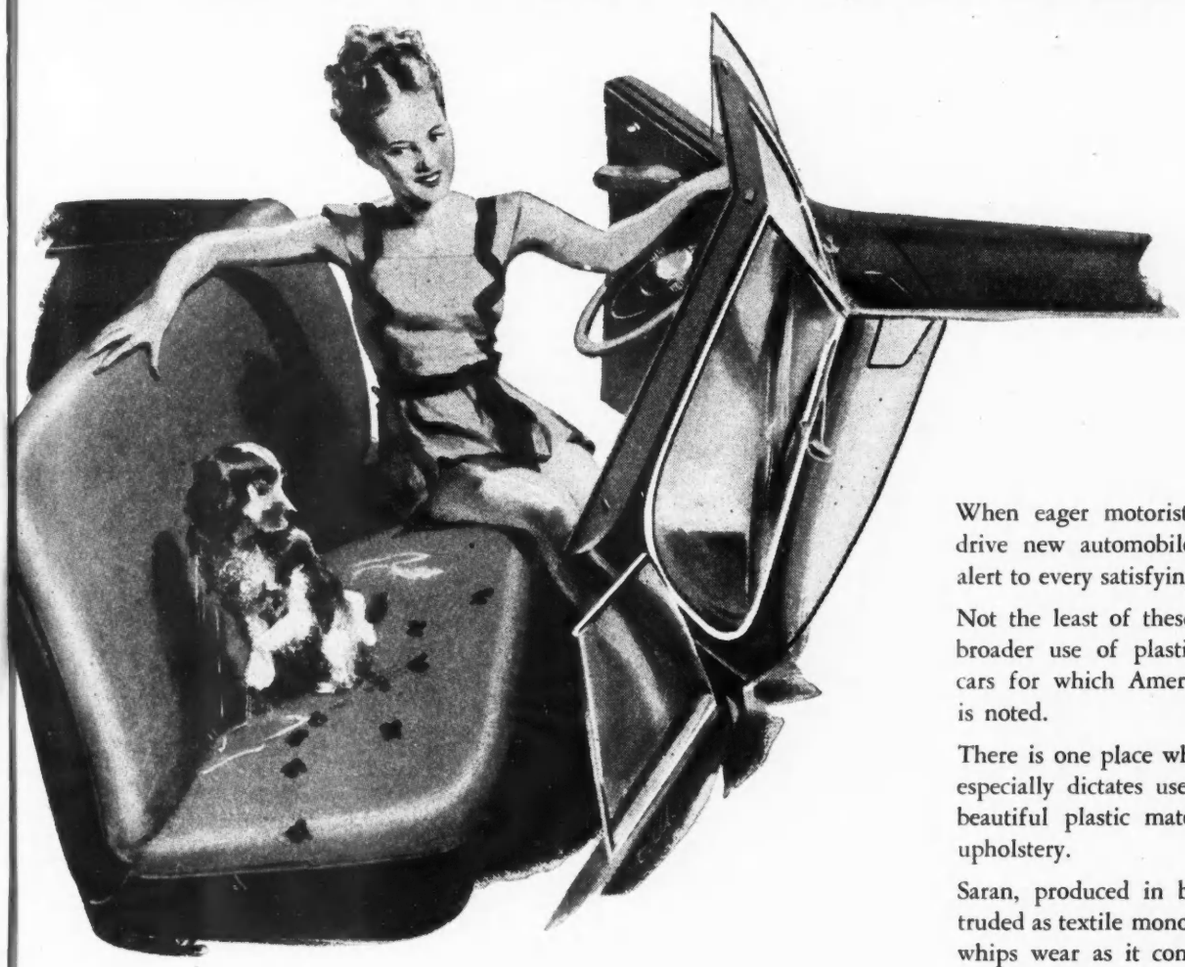
Private industrial building volume in 1945, according to *Engineering News-Record,* totaled $635,170,000, an all-time peak—the data covering projects of $40,000 or more each. The figure is 7 per cent greater than the preceding peak—in 1940.

The wholesale price index of the Bureau of Labor Statistics for the week ended Dec. 22 rose further to 106.8 per cent of the 1926 average, as against 106.7 a week earlier and 104.6 a year before.

Member bank reserves increased $242,000,000 during the week ended Jan. 2. Underlying changes reflected include a decrease of $325,000,000 in Reserve bank credit and a drop of $428,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a decline of $158,000,000 in money in circulation.

Total loans and investments of reporting member banks decreased $369,000,000 during the preceding week. A rise of $27,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $7,268,000,000, shows a net increase of $750,000,000 in twelve months.

YOU'RE IN THE DRIVER'S SEAT WITH SARAN!



When eager motorists get behind the wheel to drive new automobiles, they will, of course, be alert to every satisfying change.

Not the least of these, Dow believes, will be the broader use of plastics in the ever-better motor cars for which American automotive engineering is noted.

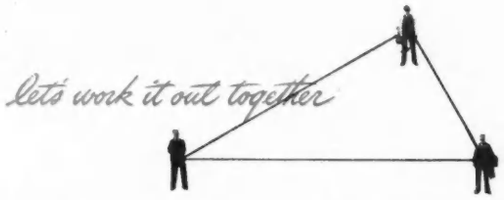
There is one place where the need for ruggedness especially dictates use of a rough-and-tumble but beautiful plastic material like Saran. That is in upholstery.

Saran, produced in basic form by Dow and extruded as textile monofilaments by skilled licensees, whips wear as it conveys new attractive coloring to difficult spots like automobile seats. Its tough strands weave new concepts of what motorists can expect in comfortable but practical car interiors.

There's virtually no scuffing with Saran. And it's impervious to dirt, stains, rot, water and most chemicals, even acids. A moist cloth will keep it clean. Furthermore, colors last with Saran because they're "built-in."

Dow is sure you'll be "in the driver's seat" if you select upholstery materials from Saran.

SARAN



High accomplishments in plastics will result only when manufacturer, designer, fabricator and raw materials producer put their skills together, working as a team. In the interests of achievement, therefore, Dow urges you to save time and money by putting its experts to work on *your* problem. They'll do their part.

Present and Potential Uses:

Plating masks; chemical apparatus; pump parts; valves and valve parts; name plates; meter parts; paint brush handles; insulation; stoppers; funnels; bottles; closures; plumbing parts and equipment; wire coating, etc.; pipe and tubing for installations requiring chemical and corrosion resistance; monofilaments for textile fabrics.

Properties and Advantages:

Resistant to chemicals, abrasion, corrosion, water, and moisture; good electrical insulator; excellent thermal insulator; non-flammable; tough; flexible; dimensionally stable; not recommended for installations requiring temperature resistance above 170° Fahrenheit; tends to brittleness at very low temperatures.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW

PLASTICS

STYRON • STYRALOY • ETHOCEL
ETHOCEL SHEETING • SARAN • SARAN FILM

Factories Approaching Volume Production

(*Continued from page* 42)

already has felt the pinch on bearings purchased from G.M. Nash reported shortly before closing that front window ventilators purchased from the Ternstedt Div. of G.M. were running low and that no alternate source of supply had been found.

In view of the uncertain conditions prevailing ahead in both labor and certain materials which still are in scarce supply, there is considerable doubt that the industry will be able to do more than reach the 1941 production of 3,774,300 passenger cars. Hopes for building more than a million trucks and commercial cars this year already have been abandoned and there is some pessimism about the chances of reaching the 1937 level of 893,000 vehicles.

Industry spokesmen also are indicating that the setbacks caused by the strikes may result in fewer changes and improvements in 1947 models. At General Motors, for instance, much of the development work has been stymied since the strike began. Another factor that may influence model changes in the possibility of announcing new models earlier than usual. Ford, for example, is shooting at an announcement date of early September.

CALENDAR

Conventions and Meetings

National Aircraft Show, Cleveland — Jan. 11-20

American Institute of Elec. Engineers, New York — Jan. 21-25

American Society for Metals, Cleveland-Natl. Metal Show — Feb. 4-8

American Society for Testing Materials, Pittsburgh Spring Meeting — Feb. 25-Mar. 1

Pan-American Aircraft Exposition, Dallas — Mar. 1-5

Second Northwest Annual Airshow, Minneapolis — Mar. 12-18

Amer. Soc. of Mechanical Engineers—Spring Meeting, Chattanooga — Apr. 1-3

American Management Association, Atlantic City, N. J., Packaging Exposition — Apr. 2-5

SAE Natl. Aeronautic Meeting, New York, N. Y. — Apr. 3-5

Midwest Power Conference, Chicago — Apr. 3-5

American Society of Tool Engineers, Cleveland Tool Engineers Exposition — Apr. 8-12

The Chamber of Commerce of the United States — Annual Meeting, Atlantic City — Apr. 30-May 2

Natl. Assoc. of Corrosion Engineers, Kansas City, Mo., Annual Meeting and Convention — May 7-9

Associated Business Papers, Hot Springs, Va., Spring Meeting — May 22-25

Amer. Soc. of Mechanical Eng.—Detroit — June 17-20

Natl. Industrial Adv. Assoc., Atlantic City — June 20-22

American Society for Testing Materials, Buffalo Annual Meeting — June 24-28

Natl. Chemical Exposition, Chicago — Sept. 10-14

PUBLICATIONS

Olsen Type E-O Static-Dynamic Balancing Machines, a new booklet published by Tinius Olsen Testing Machine Co., contains detailed explanations of the construction and operation of horizontal and vertical types of balancing equipment. It is well illustrated and includes a drill chart for use with Olsen balancing machines.*

Youngstown Welding & Engineering Co. has published a new 15-page folder illustrating and describing standard and special equipment designed, built and fabricated by the company. Equipment described includes **tubing and fittings, pickling and heat treating equipment, corrosion resisting rolls and miscellaneous items.***

The complete line of **Terry angle and flexible drilling attachments,** including many war-production inspired attachments, are shown in a new catalog, No. 45, issued by George A. Terry Company.*

A 64-page **Die Service Manual** containing complete information on the finishing and servicing of carbide dies for deep drawing and for the production of wire and shaped stock has been issued by Carboloy Co., Inc. The manual is divided into sections according to die size and type. Nomographs for the determination of correct back opening diameters and meeting point diameters and a two-color panel explaining the nomenclature for blank, rough cored and rough drilled carbide dies are included, together with suggestions for die room layouts, storage and handling methods and equipment.*

The latest issue of **The Pantasote,** published by the Pantasote Corp., contains an article on the history of the automobile, From Jalopy to Streamlined Dream.*

American Chemical Paint Co. has published Technical Service Data Sheet No. 11-5 on **Peroline,** designed to prevent rust and destroy rusters in one operation, and also prepare the surface properly for painting.*

Acme Marking Equipment Co. has announced the publication of a new catalog describing its complete line of **marking equipment.** It is well illustrated and features a thumb index in the front and back of the book. A carefully-planned classified arrangement makes for quick reference to the materials desird.*

A new folder on Norton **B-5 Resinoid Wheels** for foundry grinding has been published by Norton Co.*

A new 12-page booklet describing **Norelco Industrial X-Ray** equipment has been announced by North American Philips Co., Inc. Various models of Searchray are described and illustrated and specifications are included. The X-ray Spectrometer and camera-type X-ray Diffraction unit are also described.*

The B. F. Goodrich Co. has issued a new **Guide to the Selection of Conveyor Belt Grades.** The folder discusses differences in various grades; outlines measurements of qualities in various types of belts and the service for which they are usually applied. Description and data, together with uses for each of its conveyor belt grades, together with those for special constructions are also contained in the guide.*

Precise Production, featuring the new Scherr **Gage Block Utility Set,** has been issued by George Scherr Co., Inc. Also described and illustrated in the folder is the Scherr ball-Joint back indicator set with magnetic base for speeding dial indicator set-ups*.

A new folder, **Hastelloy Facing for Corrosion Resistance,** describing a new process used to protect chemical-plant and oil-refinery equipment from corrosion, has been issued by Haynes Stellite Co., a Unit of Union Carbide and Carbon Corp. Concise data on grades of Hastelloy available is given and the corrosive media they will resist, etc.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

Torsion Bar Suspension

(*Continued from page* 23)

Special attention was given to design details leading to ease of installation, special adjustment, and for maintenance operations. For example, all bearings are O & S pre-loaded sealed type. It was observed on test models that no wear could be observed on units which had been in service up to 100,000 miles.

Torsion bar mounting has been so designed as to make it a matter of minutes for a complete replacement or for resetting to meet some special operating conditions. By removing the outer cover, it is possible to slide out the torsion bar without difficulty. Similarly the spring height on either side of the trailer can be adjusted independently to accommodate for eccentric load conditions or for continuous operation on highly crowned roads.

Except for the replacement of a torsion bar on a resetting to meet special operating conditions, as mentioned above, it is unlikely that service adjustments need be made during the life of the vehicle. However, if a torsion bar happens to take on a permanent set for one reason or another, a simple adjustment will bring it back to proper alignment, by compensating for the change in position.

Wages, Prices & Profits

(*Continued from page* 15)

proceedings, they acted, as many of us agree, in the best interests of the country. On the other hand, the union's refusal to comply with the President's request to send its members back to work obviously had, definitely and immediately, a deleterious effect on the general welfare, for production is what the country needs most today to cure its major ills.

Profits, prices and wages are all, of course, vital factors in our free economy. They are related each to the others and to the whole but not in the way the present spokesmen of the UAW-CIO would have us believe. The facts regarding them are clearly stated in the quotations above from the General Motors reply to the union's "or-else" demands for inordinate wage increases. They are here again recorded in the interest of truth and understanding.—J. C.

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BIGGER AND BETTER THAN EVER

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SEALED Power factories are today the largest in all Sealed Power history. Sealed Power laboratory facilities have been expanded, and 34 years of successful experience have made Sealed Power personnel familiar with all manner of piston ring problems. Feel free to use the full resources of Sealed Power to help make your good engines even better.

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PISTONS — CYLINDER SLEEVES

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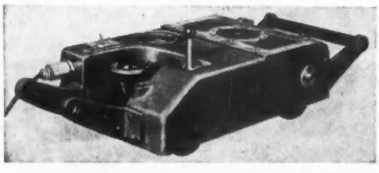
New Production Equipment

LEMAIRE TOOL & MANUFACTURING CO., Dearborn, Mich., has developed a new hollow milling machine for heavy-duty work. One feature that characterizes this special purpose machine is that it is built up of several standard elements. A standard LeMaire No. 5000 hydraulic unit mounted on a standard base is used to power each of the four stations. All four bases, arranged at right angles to each other, abut a central base, which carries a special fixture. Each unit is a machine by itself and can be operated at speeds independent of the others. Infinite feeds are controlled by flow valve and the spindle speeds are controlled by a rheostat located on a variable speed unit within convenient reach of the operator alongside the machine. Since separate motors are employed to furnish power to the hydraulic pumps and to the spindles, any desired change in the speed of one does not affect the speed of the other.

LeMaire hollow milling machine

The machine was designed to hollow mill and face shoulders on universal joint spiders with journals ranging from ½ in. to 1⅛ in. A production of approximately 180 pieces per hour is claimed for spiders having journals ¾ in. long and ¾ in. in diameter.

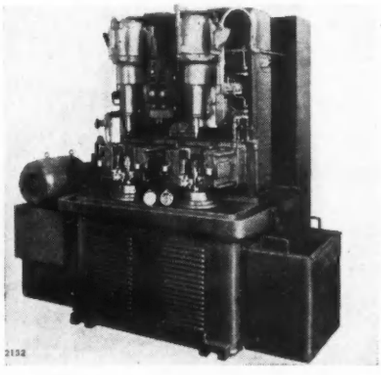
A NEW HEAVY-DUTY, straight line machine, known as the Oxweld-Union melt CM-37 machine carriage, has been developed by the Linde Air Products Co., Unit of Union Carbide and Carbon Corp. It can be used for carrying Unionmelt electric welding equipment, the CMA-21-B attachment for plate-edge preparation, single- or multiple-blowpipe setups for straight-line cutting, flame-hardening equipment, and the Oxweld C-45 blowpipe for cutting extra-heavy sections.



Oxweld-Unionmelt CM-37 machine carriage without equipment

The use of high-strength aluminum alloys in the construction of the machine provide it with a high strength-weight ratio. Its weight as sold, without equipment, is 87 lb; thus it can be moved readily from job to job. Its overall dimensions are 32 in. long, 12½ in. wide, and 9 in. high, plus 2⅞ in. for the forward-reverse lever. The standard machine is equipped with a 110-volt ac unidirectional motor of ¼ rated electrical hp. Reversing is accomplished mechanically through gears. Machines are supplied with speed ranges of 2 to 50 in. per min for general industrial use; and 7 to 210 in. per min for use with the Unionmelt welding process.

SNYDER TOOL & ENGINEERING CO., Detroit, Mich., has designed and built a special machine for performing one or several of the operations involved in processing pistons. This particular machine is a two-spindle automatic for counterboring, facing and centering aluminum alloy pistons and its design is such that it can readily be re-tooled for other pistons at relatively little cost.



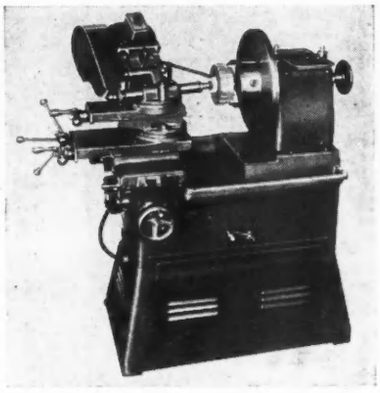
Snyder special machine for performing operations on pistons

The machine is a double-station set-up; each spindle is independent of the other and can be loaded and started separately if necessary. There are two slides provided with cutting tools, one set for roughing and one set for finishing.

The part is positioned and secured on a vertical stub spindle by means of a pin chuck. The work cycle consists of loading the part and pressing the clamp button which automatically positions and secures the part on the arbor through hydraulic action. When clamping is completed the spindle is started and the tools enter the work, cut to the required depth and automatically withdraw.

The accuracy of the cut and the conformity of the finish to specifications are maintained by the use of carbide tools.

THE new design of the Lempco Model ACX Multi-Purpose grinder, made by Lempco Products, Inc., Bedford, Ohio, has the wheel-head mounted on two different compounds, each graduated to 180 deg, thereby permitting even the most difficult of internal or external taper grinds or turns to be easily and accurately done.

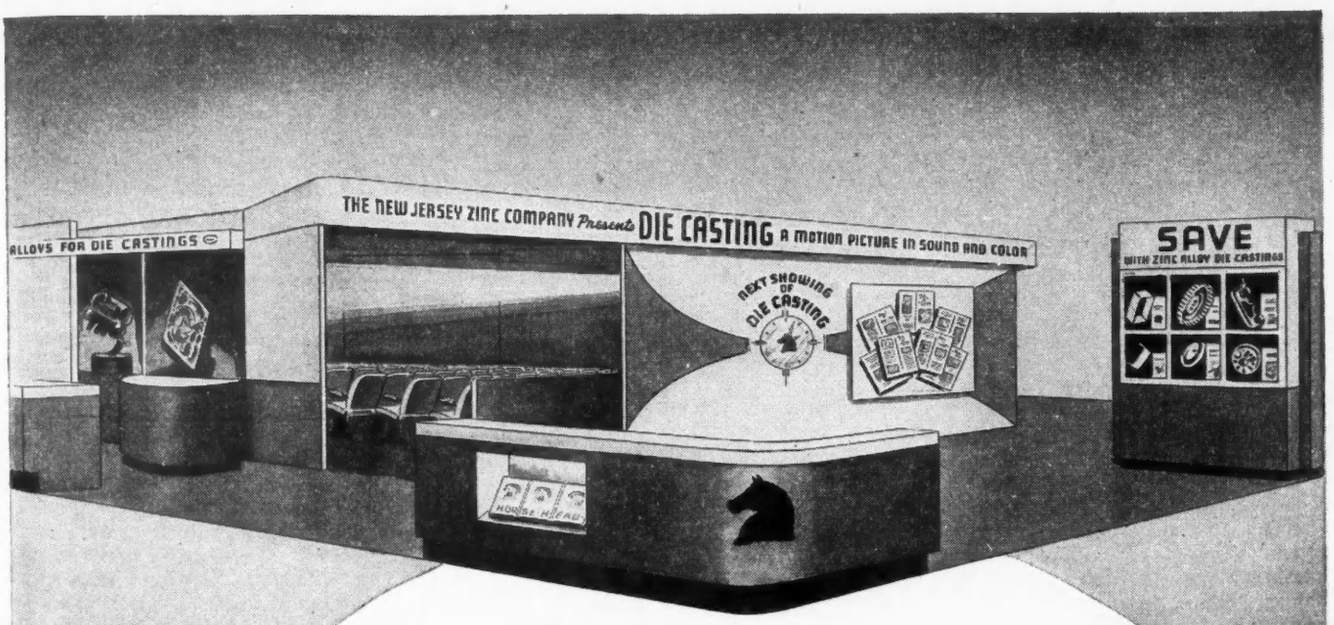


Lempco model ACX grinder

Another new feature is that the workhead can now be moved 6 in. toward or away from work by removing and replacing four screws. By so doing, the swing can be increased from 18 in. to 30 in. It has both hand and power cross-feeds, a work length capacity up to 8 in., and two reversible spindle speeds of 80 and 130 rpm. Chucks are mounted on the face plate by a draw bar which extends through the spindle. Wheel-head has a two-hp motor with ball-bearing spindle, and speeds of 6,000 and 12,000 rpm. A retractible tool holder bar enables finished grinding to follow turning operations without removing the cutter. The power cross-feed can be set to any desired length by dogs on the side of the carriage. Longitudinal feed is controlled by a quickly interchangeable screw or rack and pinion. An automatic sizing device insures duplication of successive pieces on production runs.

DENISON ENGINEERING CO., Columbus, Ohio, is introducing Multi-Unit Hydroilic power—a group of "packaged" hydraulic press components in unit form. These units offer designers and users of special machinery a ready means of installing 4 and 6-ton oil-hydraulic pressure, and pressing action, in equipment especially designed to meet unusual or specific manufacturing needs.

(*Turn to page* 104, *please*)


THE NEW JERSEY ZINC COMPANY Presents DIE CASTING A MOTION PICTURE IN SOUND AND COLOR
ALLOYS FOR DIE CASTINGS
NEXT SHOWING OF DIE CASTING
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If you are planning to attend the National Metal Exposition in Cleveland, you will have an opportunity to get the answers to questions you may have on die castings.

In Booth B-730 you will see the motion picture "Die Casting" in a comfortable theatre. You will be able to examine a comprehensive collection of brand new zinc alloy die castings—both as-cast and finished. In many cases you will also see the completely assembled products in which the die castings are used.

Whether you want to "just browse around," or to sit down in a quiet corner with one of our Technical Service representatives, you will be most welcome at Booth B-730.

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HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

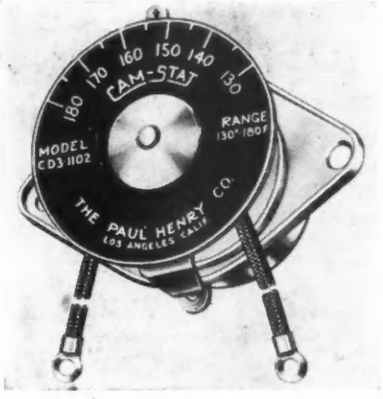
New Products

Adjustable Calibrated Temperature Controls

Many advantages are claimed for a line of adjustable calibrated Cam-Stat temperature controls recently announced by Paul Henry Co., Los Angeles, Cal.

Among these are: a precise dial selection of the temperature control point with uniformity of dial accuracy in all units, virtually no increase in space required for mountings or in cost over other thermostats without calibrating dial, tamper-proof dial installation preventing changing of adjustable range provided at the factory, and a ready adaptability to specially styled adjusting knobs and other design requirements.

The model shown has an adjustable range applicable to the control of water heaters. A wide choice of adjustable ranges is also available between —50 F and 600 F, with differentials as low as 1 deg F. The Cam-Stat may be clamped on the tank or the element may be immersed in water.

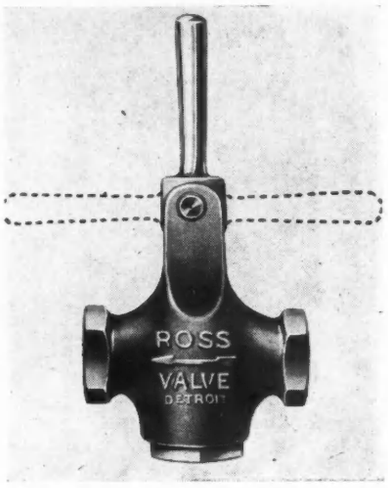


Cam-Stat temperature control

New Shut-Off Valve

The Ross Operating Valve Company, Detroit, Mich., has just added a shut-off valve to its line of poppet type, air operated valves. This new valve was primarily designed for use in air lines but is also recommended by the maker for use in gas and low pressure liquid lines.

Five features of this new valve are: Full flow, that is to say, full pipe area; quick acting, just a flip of the lever opens or closes the valve; self-locking, locks automatically in both closed or open position; positive shut-off, line pressure provides leakproof seal; and visual indicator, position of shut-off lever indicates whether valve is closed or open.



Ross shut-off valve

Four standard sizes are now in production, ¼ in., ⅜ in., ½ in. and ¾ in. Made of non-corrosive metals, of simple design, and few parts, are further claims by the manufacturer.

New Solvent Cleaner

The Optimus Detergents Co., Matawan, N. J., has introduced a new solvent cleaner, Optimus Solvent No. 2. The product is said to be quick and effective in removing grease, oil, carbon, grit and miscellaneous shop dirt from metal parts.

Originally developed for cleaning of parts to facilitate inspection, this new material is finding usage in other industrial cleaning operations. Proper solvent blending in the making of this new product provides more versatility in the selective attacking of greases and dirts to be removed.

Though compounded to give maximum cleaning strength in operation, Optimus Solvent No. 2 will not harm metal surfaces or operator's hands. Its odor is clean and entirely free of toxic and irritating fumes.

Completely miscible, this product will combine in kerosene or other hydrocarbon diluent, and remove soil from work by solvent cleaning action. In spray-type washing machine operations, it may be diluted at a ratio of 1 to 7 parts in fuel oil. Pressure of 20 lb has been found sufficient. A water rinse emulsifies the solvent and kerosene mixtures, rendering physically clean surfaces suitable for further processing. Properly diluted with water, it is also applicable as a pre-soak prior to electro-cleaning to remove tripoli, rouge and similar buffing compounds.

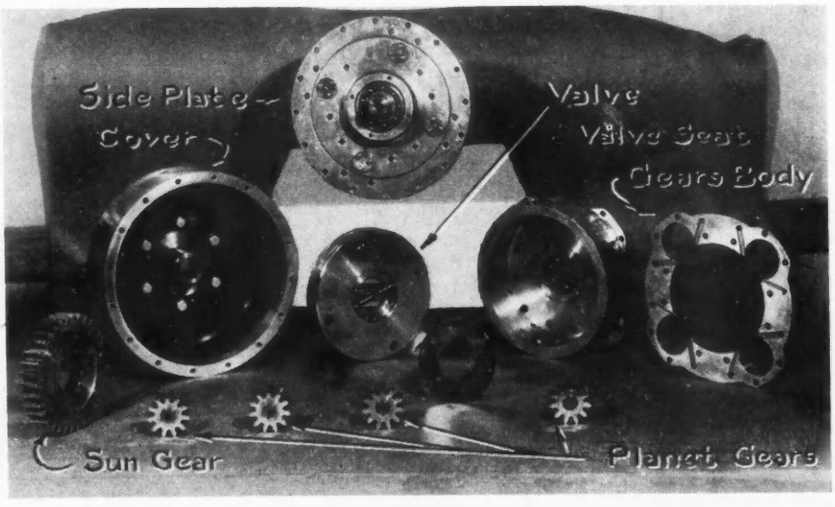
Hydrostatic Clutch or Speed Control Unit

The Brad Foote Speed Flo Drive—a self-contained hydrostatic unit suitable as a clutch or speed control unit—is offered by the Brad Foote Gear Works, Cicero, Ill., on an engineered application basis for installation on heavy duty motor trucks, buses, machine tools, hoists, and industrial drives.

The unit can be employed as a hydrostatic clutch where smooth clutch action is desired; or as a hydraulic speed control unit when equipped with a centrifugal governor for automatically controlling the action of the valve regulating the oil pressure. A complete line of speed controls also is contemplated for special purposes.

One important feature is said to be the cushioning of shocks which are normally transmitted to the power drive

(*Turn to page 78, please*)



Entire Speed Flo clutch disassembled to show the component parts. Nomenclature on this plate corresponds to the text.

New Products for Aircraft

Radar Generator with Good Wave Form

Radar sets require power supply with good sine-wave form. Yet the characteristics of the radar load is such as to distort the wave form of conventional generators. Usually to power aircraft radar, special dc-ac sets (inverters) are provided.

To save weight on large airplanes with large radar loads an engine-driven 400-cycle generator that would maintain good wave form was built at the Small Motor division of the Westinghouse Electric Co. Such a machine would save much weight by generating the a-c power in the first place instead of d-c generation and subsequent d-c to a-c transformation, thereby eliminating the weight of the inverters. Also the radar energy would be obtained more efficiently because the losses of the rotating electrical transformation would be obviated.

The resulting 8-kva machines weighed but 48 lb, which in one installation represented a reduction in weight of 250 lb using inverters. To obtain the 400 cycles at the minimum alternator speed of 4000 rpm 12 poles were required. For obvious space reasons these had to be placed on the stator, requiring a rotating armature.

Lightest Engine per Horsepower

The Wright Cyclone 9HD, just brought out by the Curtiss-Wright Corp., is said to be the world's lightest aircooled engine per horsepower.

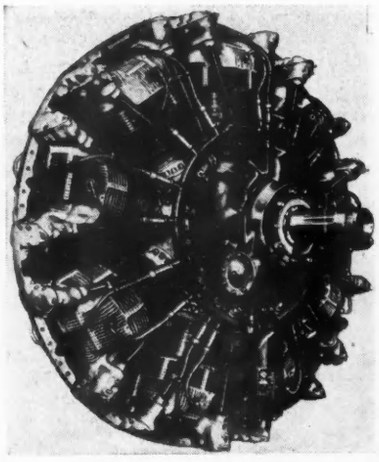
The new engine develops 1425 hp, 75 more than its immediate predecessor in the Cyclone 9 series, yet it weighs only 1352 lb and delivers one hp for each .85 lb of dry weight.

Basically, the 9HD is built on the same lines as earlier models of the Cyclone 9 type, but advancement in cooling, supercharger efficiency and structure made possible increased output from the 1823 cu in. which have been standard displacement of the series for several years.

Cooling in the Cyclone 9 has been improved by use of a new type forged aluminum cylinder head with differential finning. Among structural features are the added strength gained through use of the forged head, stronger power transmission parts, oil jets for increased cylinder and piston ring lubrication, high durability valves, and increased cam overlap for improved detonation characteristics.

An "impeller inducer" which adds to both pressure and efficiency of the

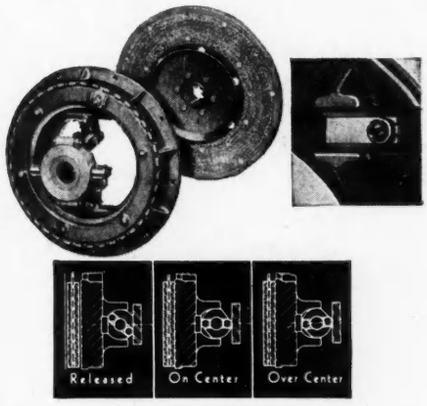
(*Turn to page 68, please*)



Wright cyclone 9HD

Specify ROCKFORD OVER-CENTER for CLUTCHES

EASY OPERATION
HIGH TORQUE
POSITIVE ENGAGEMENT *
LARGE DRIVING AREA
SMOOTH RUNNING
INFREQUENT ADJUSTMENT
MINIMUM INERTIA

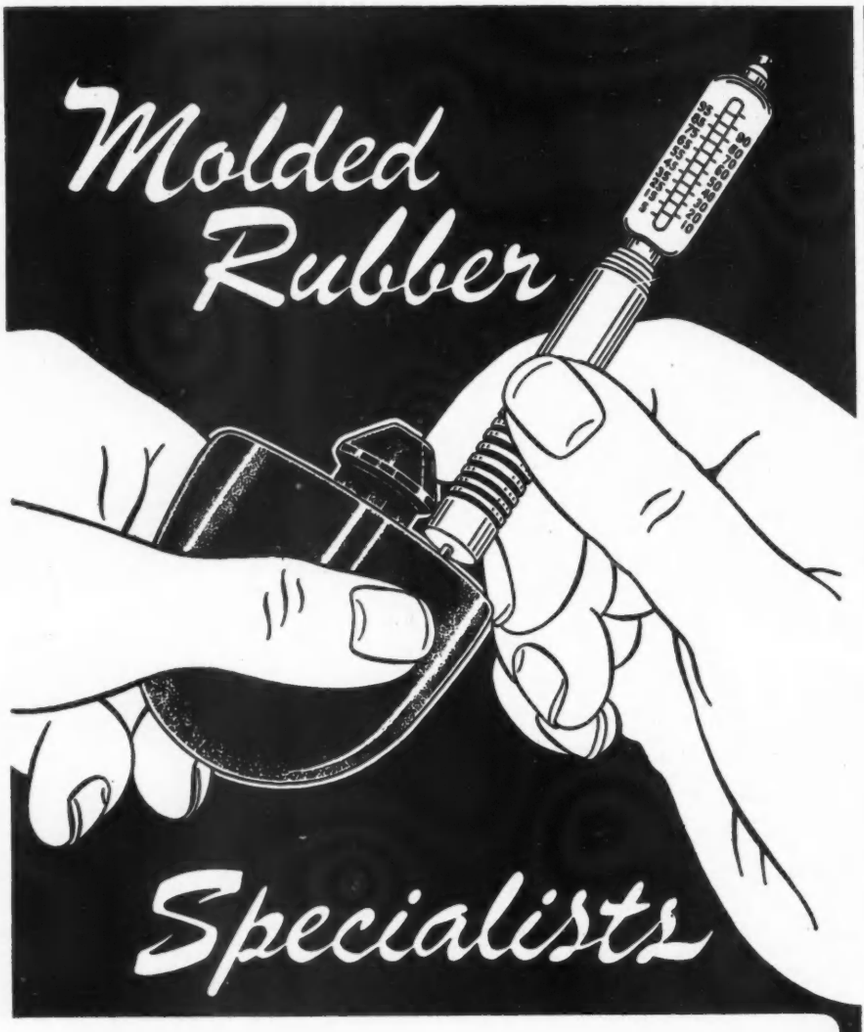


* ROCKFORD Over-Center CLUTCHES remain *in* or *out* of engagement – until, changed by the operator. The smooth, easy, anti-friction engagement — obtained by roller cams pressing against the pressure plate face — progresses from "release" to "on center" to slightly "over center" where the clutch locks itself in *engaged* or running position.

SEND FOR THIS HANDY BULLETIN ON POWER TRANSMISSION

It shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications. Every production engineer will find help in this handy bulletin, when planning post-war products.

ROCKFORD CLUTCH [FORMERLY KNOWN AS] DRILLING MACHINE DIVISION BORG-WARNER CORPORATION
315 Catherine Street, Rockford, Illinois, U.S.A.



BECAUSE Continental has specialized in molded rubber products for over forty-three years, you will find them of real help in working out the correct design, the preferred compound and the proper method of manufacture.

When you have molded rubber problems consult your Continental branch, or write direct.

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★ *Continental also manufactures extruded and lathe cut goods, as well as a complete line of hose, packing and other industrial maintenance items.*

SEE OUR CATALOG IN SWEET'S

CONTINENTAL RUBBER WORKS
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SAE Meeting

(*Continued from page* 29)

ahead some 10 years; and "Motor Coaches of the Future," by L. H. Smith, General American Aerocoach Co., looking ahead some 20 years; and "Highways of the Future," by H. S. Fairbank, Public Roads Administration. Mr. Cass visualized the motor trucks of 10 years from now traveling possibly 70 mph on the highways. Such vehicles might have powerplants of 300 hp, of gas turbine type, provided the gas turbine by that time could handle an inlet gas temperature of 2000 F. On the other hand, the author saw the potentialities of further development of perhaps revolutionary character in the reciprocating engine. This too would be of about 300 hp and should have a service life potential of at least 100,000 miles with the goal set at 500,000 miles.

L. H. Smith visualized the bus of the future as a vehicle carrying 41 passengers. It would have many comfort features, including an annunciator system within the vehicle. For power, the coach would have a gas turbine coupled to a generator and driving motors at the wheels. The suspension would be new and would eliminate leaf springs. Tires would be of small diameter and large cross section, and without air. Polaroid window glass would be used all around, with Polaroid headlamp lenses.

A symposium on passenger car suspension covered the elements of the system, including the suspension proper, shock absorbers, and steering gear. Out of this session came a valuable paper analyzing suspensions, by Robert Schilling, General Motors Corp.

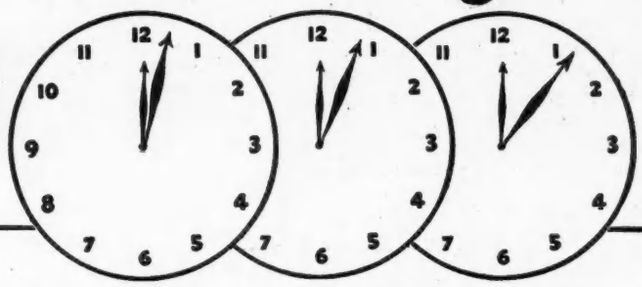
The symposium on automatic transmissions was presented to an overflow gathering. Whereas, only a few years ago the automatic transmission was almost an academic matter, today most engineers consider it to be the thing most desired in a passenger car.

W. S. James, Ford Motor Co., laid down the requirements of an ideal transmission, admittedly one which is not yet available. R. J. Miller, Bendix Aviation Corp., A. H. Deimel, Spicer Mfg. Co., and Renke Brunken, White Motor Co., described the offerings of their organizations in hydro-kinetic transmissions of differing types.

The annual production session covered a paper by S. Johnson, Jr., Bendix-Westinghouse Automotive Air Brake Co., on the use of air cylinders for air clamping in production operations, and a description of the latest developments in honing techniques by L. S. Martz and W. T. Peden, Micromatic Hone Corp.

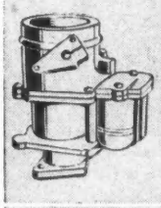
One of the most important papers of the closing sessions was entitled, "Motor Oils—Regular, Premium, and Heavy Duty," by H. R. Wolf, General Motors Research Laboratories, describing a new classification of motor oils in keeping with the development of additives for heavy duty engine use.

How to Cut Metal Cleaning Time to MINUTES



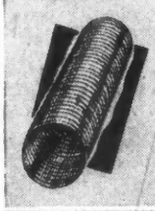
NEW, FAST-ACTION DETERGENT CLEANS FERROUS AND NON-FERROUS METALS...Easy to Handle

TYPICAL USES FOR Solvent "26"

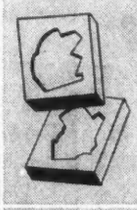


CARBURETORS—Solvent "26" removes gum, gasolene sediment and other accumulations of dirt.

SPARK PLUGS—Solvent "26" safely cleans porcelain; helps loosen carbon deposits.

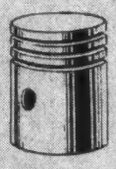


METAL PLATES AND SCREENS—Solvent "26" restores clear, clean finish to any metal surface.



DIES AND STAMPING—Solvent "26" removes drawing compounds from die-formed or stamped metal.

LABORATORY EQUIPMENT—Solvent "26" frees glass and metal tubing and their supports of gums, varnishes and other incrustations or deposits.



PISTONS—Removes lacquers, gums, resins, etc. from gas, gasolene and diesel engine pistons and rings. Also effective for cleaning all parts of dismantled motors, engines and machinery.

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The fast action of Solvent "26" reduces cleaning time from hours to minutes on dismantled engine parts and all kinds of machinery. Simply dip, rub, brush or spray it on. Then flush clean with hot water.

Mail the coupon today for literature and information leading to a demonstration of this unique product in your own plant.

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SAE Aeronautic Meetings

(*Continued from page* 38)

made up by bench rigs to stimulate engine sump oil should be checked for fineness of division as well as quantity of air content. We think a modified Westphal specific gravity balance will do the trick, since what needs to be read is the rate of change of density out toward the end of the settling cycle.

Oil boost pumps offer an expedient to offset or alleviate a case of high air entrainment when it is found to limit service operations. In cooperation with Ingersoll Rand, a design was developed which clears the obstacle of cold-starting, high power absorption and attendant excessive weight. For an engine having an oil flow rate of 200 lb per min., the pump provides 3.0 psi boost up to 40,000 ft with a ¼ hp electric motor and, if it is desired, can be arranged to come into action only above a predetermined altitude. It would make 35,000 ft seem only 21,000 ft to the engine pump and, at that altitude, reduce a 15 per cent entrained air volume to an effective 8 per cent. The complete unit would weigh about seven pounds.

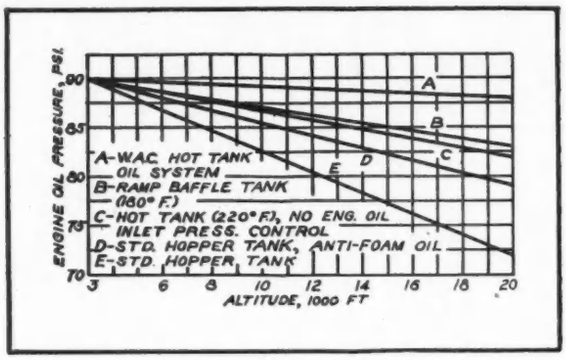


Fig. 14 — Comparison of oil pressure drop in standard and modified airplane oil systems in rated power climb to 20,000 ft.

The time factor in the deaeration process, as established by the routing of oil through a tank, is so tangible a thing to work with that there is quite a variety of ways to modify it. If provisions are made in a tank for long routing and low velocity, it follows almost inherently that some of the means provided may be above oil level and offer dispersion surface for entrained air. In one tank developed, an extremely long route, low velocity path is provided by a series of ramp baffles. Flight test showed it to be an excellent separator at 180°F.

Another development in deaeration is the use of the hot tank system, our version of which is shown schematically in Fig.13. In this system, the circulating pump offers a boost to the pressure pump so that engine oil pressure as shown at the cockpit gage will be as constant as possible. This was accomplished by means of the pilot line which transmits low order positive pressure to the piston end of the relief valve in response to the pressure in the engine oil inlet line at the pressure pump. The tank used is a low velocity, spreading baffle type.

The results of flight tests on standard and modified oil systems are shown in Fig. 14. Engine oil pressure was taken as a good criterion of oil condition, in regard to air content, as all work was done at or below 20,000 ft. The drop in engine oil pressure from the initial setting is shown by an arbitrarily drawn straight line for rated power climb to about 20,000 ft. The effect of oil tank temperature on air percentage is shown in Fig. 15, and for reference, readings taken from the hot tank installation in a similar climb are in-

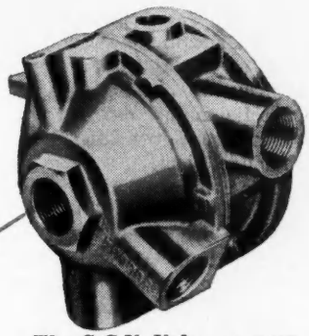
(*Turn to page* 62, *please*)

THE basis of *thorough engineering* in Lamb Electric motors is an intimate knowledge of the operating conditions of the product.

The soundness of this approach to special motor design is evidenced by the reputation for dependability gained by Lamb Electric motors in both prewar and wartime operation.

THE LAMB ELECTRIC COMPANY • Kent, Ohio

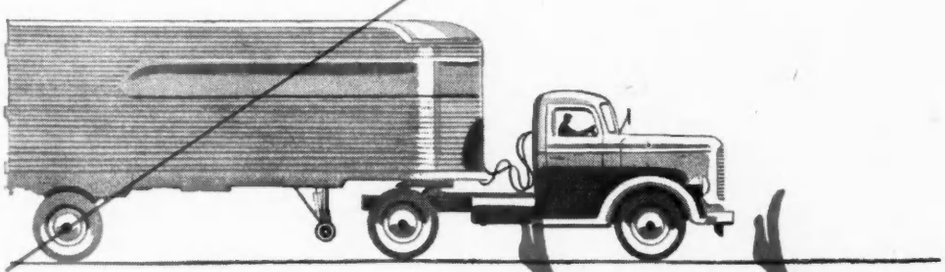
Lamb Electric
FORMERLY Black & Decker Electric
SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS



The S.C.V. Valve—a new Bendix B-K Product

THE FASTEST

Trailer Relay Valve on the market



—brings synchronized braking to tractor and trailer

Regardless of how good the rest of the tractor or trailer braking system may be, brake *balance* and *synchronization* between the two vehicles can be no better than the trailer relay valve that is used.

The new Bendix S.C.V. Trailer Relay Valve is the fastest operating trailer valve on the market. Fast opening and closing valves reduce operating time to the last split-second. Large ports and air passages allow fast, free passage of air to and from the power chambers. Close graduation gives the driver accurate control of brake application.

Make your trailer brakes do their share of the work. Eliminate objectionable trailer brake lag, as well as overbraking —common causes of costly and dangerous wheel slides, skids or poor stopping.

Include the Bendix S.C.V. Valve in your tractor-trailer brake modernization. For further details, write: **BENDIX PRODUCTS DIVISION • SOUTH BEND 20, INDIANA**

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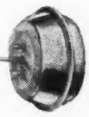
*REG. U.S. PAT. OFF.

The Ideal Trailer Power-Brake System for HYDROVAC equipped tractors

AIR CLEANER—*Keeps dirt, dust and water out of relay valve.*

VACUUM RESERVOIR—*Built to take the hardest kind of usage over the years.*

POWER CHAMBER—*A rugged diaphragm-type power chamber requiring no lubrication or maintenance.*



EMERGENCY CHECK VALVE—*Snaps shut when the connecting hose is broken. Trailer brakes automatically applied in the event of a break away.*

Bendix B-K POWER BRAKING

—for every Truck, Tractor and Trailer

cluded. Notice here the improvement in deaeration that resulted from an increase of 40 F in tank temperature. The improvement is nearly half of that accomplished by a major change in oil system configuration as represented by the developed hot tank system.

The conclusions we have reached are: that oil tanks should be operated at as high a level of temperature as engine specifications name, oil tanks be designed to give the lowest rate of flow to the largest part of the reserve oil and finally, if scavenge mixtures persist in retaining too much air for good pressure regulation, it may become necessary to add an extra pump to adapt the "hot tank" or to spend the equivalent weight in a centrifuge.

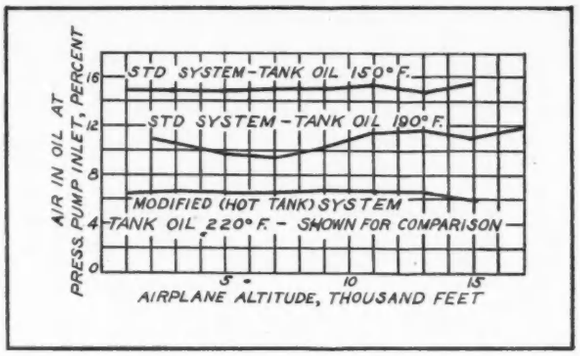
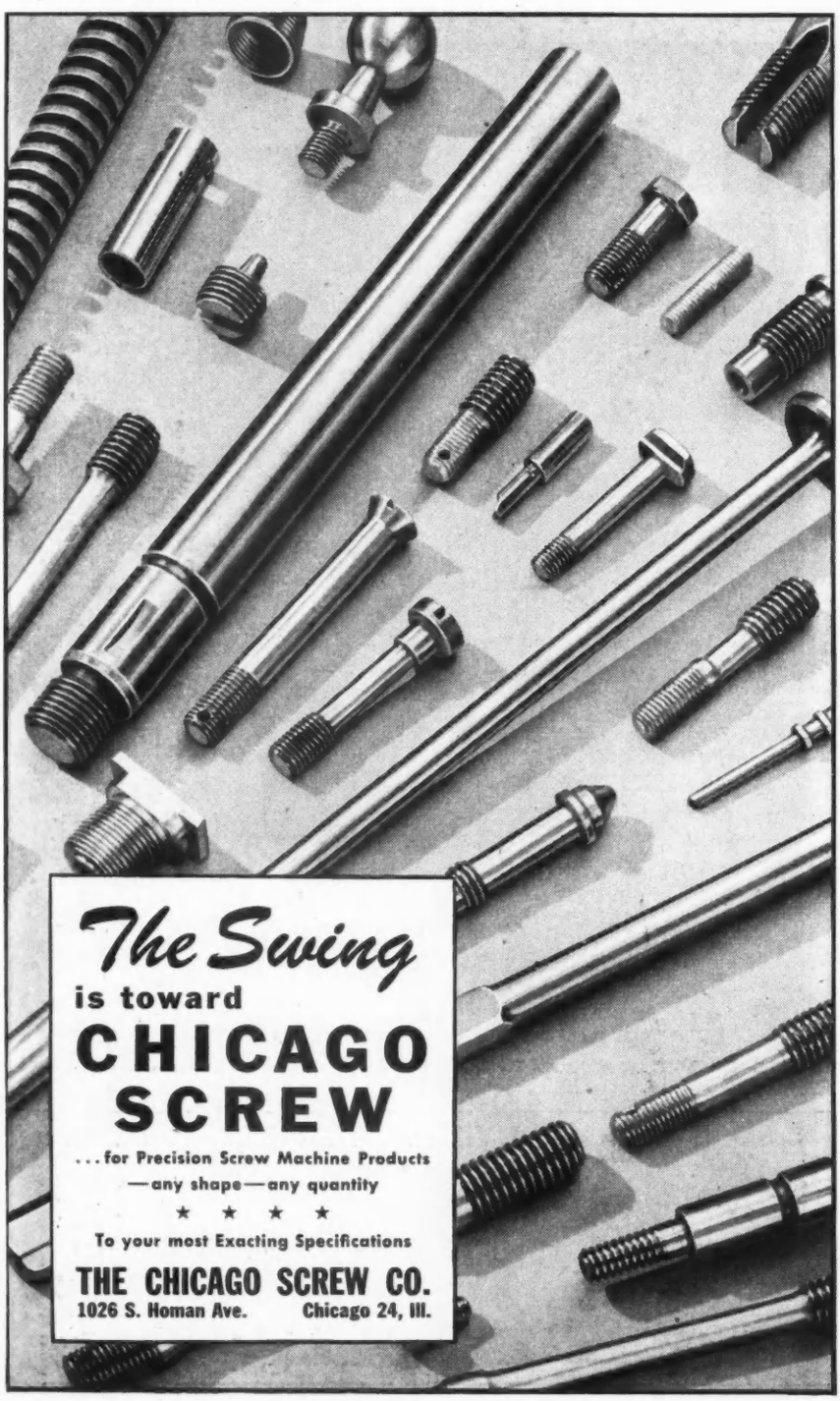


Fig. 15—The effect of tank oil temperature on aeration at pressure pump inlet in a climb to 20,000 ft.



The Airplane Icing Problem and Its Alleviation through Research

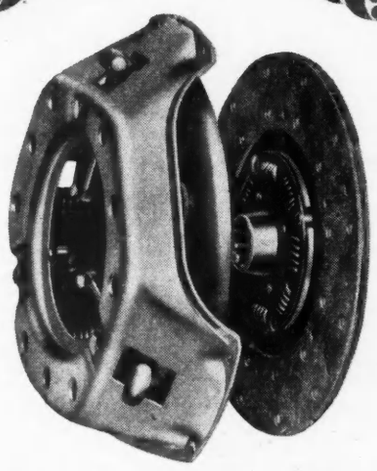
By ALUN R. JONES

Ames Aeronautical Laboratory, National Advisory Committee for Aeronautics

As a result of several years of research and development testing under natural icing conditions, the present status of the icing and heat transfer phase may be summarized in two conclusions: (1) the most satisfactory method of protection for all parts of the airplane is by heat, and (2) a satisfactory degree of protection has been obtained in all of the icing conditions encountered when design heating requirements established by NACA were achieved. These requirements are (a) 100F temperature rise in dry air for all points on wing and empennage surfaces forward of 10 per cent chord, and (b) a heat flow rate of 100 Btu's per hr per sq ft of windshield surface, with an outer surface temperature of 50F. In the case of the propeller, limited experience with electrically heated propellers in conditions of icing indicates that satisfactory protection can be obtained with a heat supply of approximately 3 to 5 watts per sq in. of surface area forward of 20 per cent of the propeller chord. This figure would correspond to a heat requirement of about 1000 to 1500 watts per blade for propellers in the 13 to 15 ft diameter range. The NACA has not yet obtained sufficient experience with the heated air method of propeller ice prevention to predict its effectiveness or to estimate the amount of heat required for its operation.

In future NACA research, a C-46 airplane is to be equipped with electrically heated test installations on the wing, propellers, and windshield by means of which the heating requirements and optimum heat distribution can be determined in known icing conditions. The test data will be used to develop a theory of thermal ice-preven-

(*Turn to page* 64, *please*)



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MEANS

DEPENDABLE PERFORMANCE

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LONG

CLUTCHES • RADIATORS • OIL COOLERS

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HARNESS
VIBRATION AND NOISE
● Three of the most destructive enemies moving parts have to contend with are vibration, noise and shock. They impair smooth operation, cut down efficiency, produce excess wear and shorten the life of any piece of equipment. Torflex Flexible Bearings were created, engineered and designed to control and eliminate vibration, noise and shock and are manufactured by Harris Products Company, pioneers in the field of engineered vibration control.
Torflex Flexible Bearings consist of a tube or ring of rubber stretched longitudinally between two concentric metal sleeves which prevent the rubber from returning to its original state. The pressure thus exerted by the rubber, on the metal sleeve, insures a high capacity mechanical bond between the rubber and metal under all operating conditions. Torflex Flexible Bearings are free from wear, also have long life, compensate for parallel and angular shaft misalignment, require no lubrication, and are widely used to transmit torque. They come in a wide range of sizes, are simple and easy to incorporate in designs and to install.
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tion based on the observed and measured reactions of the heated surfaces to the known icing conditions.

In addition to the provision of adequate heating at a minimum weight penalty, the designer of thermal ice-prevention equipment is concerned with several structural problems. One of these problems is the elevated temperature of the internal structure during operation of the heating system. These elevated temperatures have two possible deleterious effects on the structure; namely, (1) the strength of the aluminum alloy is reduced while at that temperature, and (2) temperatures in excess of certain values will cause a change in the internal structure of the alloy causing increased susceptibility to corrosion. Temperature measurements of the inner skin, nose ribs, baffle plate, and other internal components of the C-46 wing leading edge have shown that all points were at a temperature below 300F when the wing was operating at design conditions in dry air. Assuming this value as the design limit, a reduction in the allowable ultimate tensile strength for 24ST Alclad sheet of 11 per cent would be required. With regard to the corrosive effect, a review of available metallurgical information indicates that prolonged heating at temperatures below 300F will not alter the corrosion-resistant properties of 24ST Alclad sheet, providing the sheet has been properly aged. A second structural problem is the generation of thermal stresses in the wing structure caused by restrained expansion of heated portions of the leading edge.

Research and Development of Aircraft Accumulators

By K. C. MONROE
Vickers, Inc.

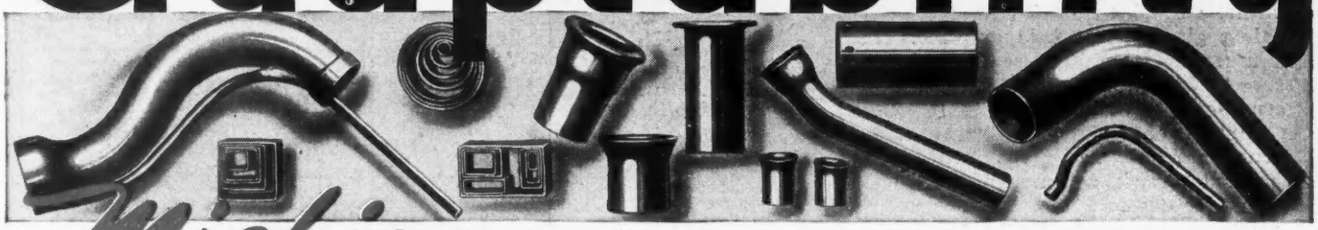
ACCUMULATORS comprise an important part of the hydraulic system in many modern airplanes. The accumulator makes it possible to maintain high system pressure for a long period of time under static conditions when the pump is not operating. It also serves a useful purpose in the absorption of pressure pulsations in the circuit.

The bag type of accumulator, in which the air charge is put into a bag or bladder, is now being used on many aircraft installations. When all fluid is discharged from this type of accumulator, the air expands the bag until it fills the entire interior space, and when the accumulation is again charged with hydraulic fluid, the air in the bag is compressed. The spherical type has proved to comply in all respects with the requirements of minimum weight, minimum overall dimensions, maximum displacement and maximum life in all types of aircraft service.

For obvious reasons, it is essential to separate the hydraulic fluid from the

(*Turn to page* 66, *please*)

Adaptability



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SIZES: ¼" to 4" O.D.
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Michigan welded steel tube can be flanged, expanded, cold drawn, fluted, flattened, bent, coiled, upset, beaded, grooved, rolled, spun, threaded, tapered, and shaped to meet every manufacturing demand.

Engineering advice and technical help in the selection of tubing best suited to meet your needs.

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air or other gas within the accumulator. The separator must be flexible within a temperature range of —65 F to 160 F and occupy a minimum amount of space. These essential requirements are fulfilled by the use of of a pliable synthetic diaphragm with an integral sealing gland firmly held in place. It is necessary that this sealing gland serve two purposes—one to prevent external leakage, and the other to prevent a mixture of air and oil within the accumulator. After a great deal of experimental work, a compound was developed that would remain sufficiently flexible for service at the extreme low temperatures required in specifications,

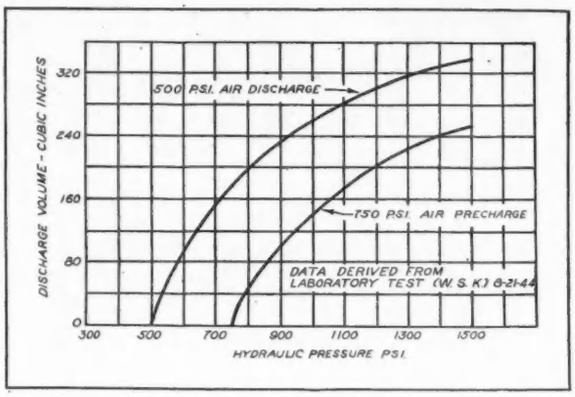


Fig. 16 — Performance curve for a 10-in. spherical accumulator designed for a 1500 psi aircraft hydraulic system.

even after having been previously operated for some time at the extreme high temperatures. In order to appreciate this problem, it must be realized that hot oil in contact with the diaphragm has a tendency to remove some of the "plasticizers" which prevent brittleness at low temperatures. Although a tensile strength in excess of 1300 psi has been recommended, it is of far greater importance that the material has a high elongation and a minimum resistance to flexing.

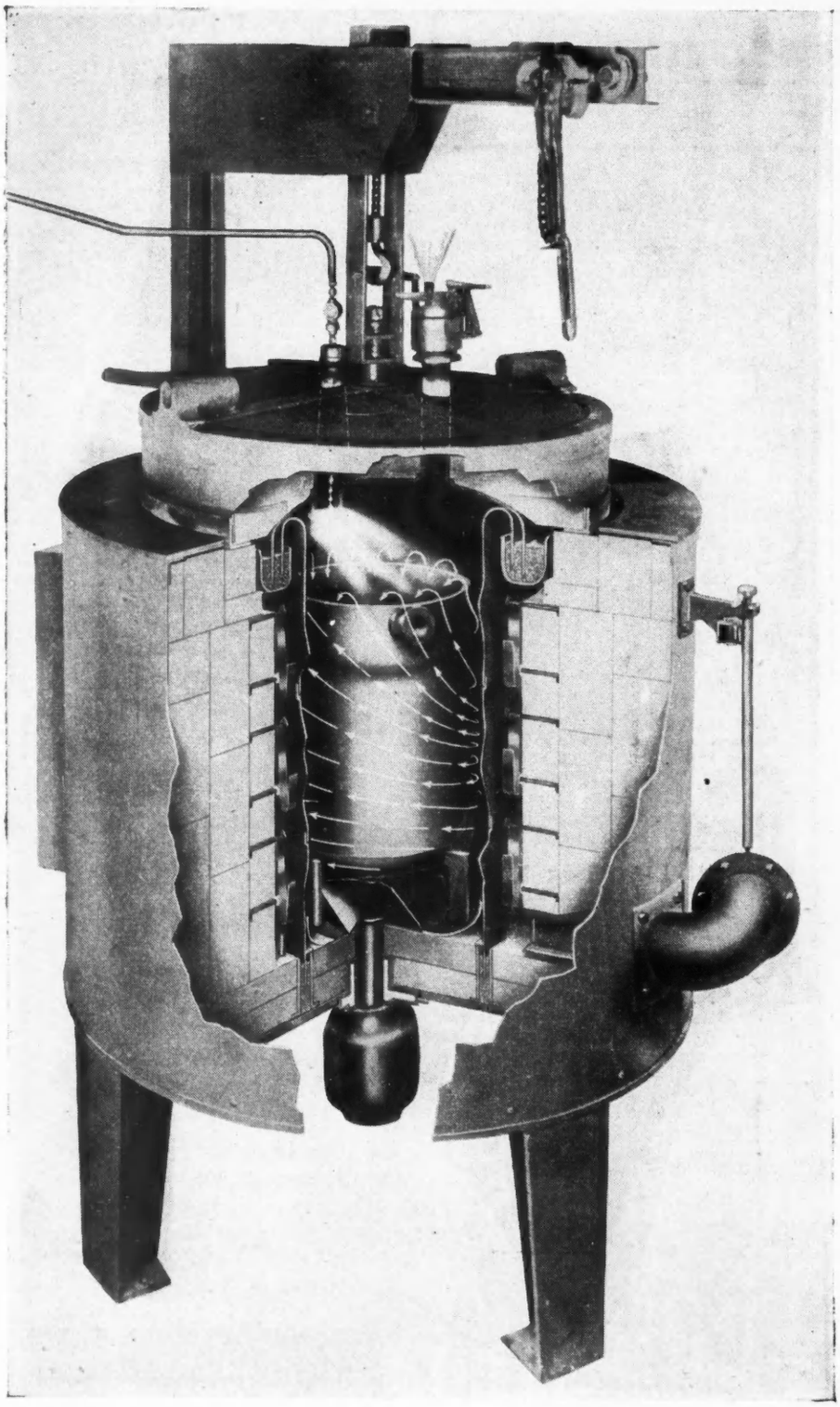
All diaphragms made from experimental materials must pass severe tests before the materials are considered suitable for production. The accumulators are subjected to a "proof pressure" test at double the rated operating pressure, to make certain there will be no external leakage, nor leakage past the diaphragm. Specifications also require that aircraft accumulators withstand static pressure of four times their rated operating pressure without failure. From these tests, three standard sizes of 1500 psi spherical type accumulators were developed to cover the requirements of practically any aircraft hydraulic system.

Fig. 16 shows the ratio of pressure to displacement for a 10-in. accumulator, as determined from actual laboratory tests. When such laboratory tests are conducted, the rate of pressure change is so slow that the expansion or contraction of air may be considered as isothermal. Of course, if an accumulator is suddenly charged or suddenly discharged, an adiabatic condition exists to some extent. In normal operation, the pressure range of the unloading valve is so narrow that for all practical purposes, system calculations may be made on an isothermal basis. From this standpoint, the diaphragm type of accumulator is preferred, as the air charge is in direct contact with the inside surface of the accumulator shell, and therefore, remains at practically constant temperature.

When the accumulators of this type were first introduced for aircraft service, it was recommended that air precharge pressure be approximately one-half that of the maximum fluid pressure. The general tendency at the present time is to use somewhat lower air

(*Turn to page* 106, *please*)

1ST IN PEACE
as it was in war!
. . the clutch that is faithfully serving nearly half the automobiles, trucks and tractors in operation today.
For THAT VITAL SPOT where POWER TAKES HOLD OF THE LOAD!
BORG & BECK
The Standard Clutch
BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO, ILLINOIS



Homocarb Method combines Micromax Temperature Control and Homocarb Furnace with cooler, in order to produce carburized parts which not only meet the most rigid specifications for metallurgical structure, but also have the extreme uniformity which spells economical production.

NEW QUICK COOLING FOR HOMOCARB FURNACE

In carburizing of metal parts, the Homocarb Method now includes a device to furnace-cool the work uniformly and quickly, under protective atmosphere. Temperature is carried down to the point at which the work is removed to the quench or slow-cooling unit.

The cooler works on a simple principle. It admits a stream of atmospheric air at the base of the Furnace. Rising by natural convection past the heaters, in the space between the furnace retort and the refractory, this stream cools the furnace about five times as fast as it would cool otherwise. The retort remains sealed during cooling and its protective atmosphere is maintained. The cooler can be added to Furnaces now in service.

Quick cooling is only one of four important Homocarb Furnace functions which combine to make the Homocarb a completely integrated equipment. Others are:

Accurately-metered supply of chemically-constant carburizing gas, supplied by scientifically-designed Homocarb Fluid.

Accurately-controlled, clean heat from the famous Homocarb electric heater.

Uniform distribution of hot gas, achieved by the Homo Method. A powerful fan, circulating gas along short, stream-lined passages and forcing it through the load, achieves entirely homogeneous results, for highest-quality production.

If you have a carburizing problem, an L&N engineer will gladly call; or you'll find general information in Catalog T-623, sent free on request.

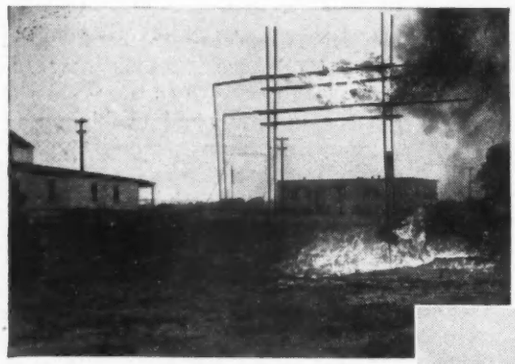
LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

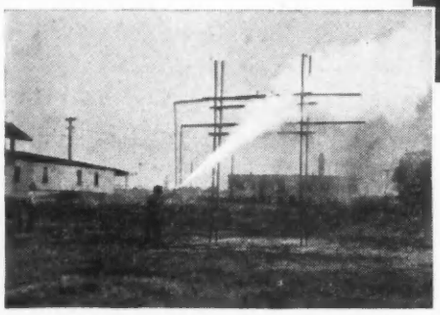
Jrl Ad T-623(21)

THIS TOUGH GASOLINE FIRE KILLED IN 65 SECONDS

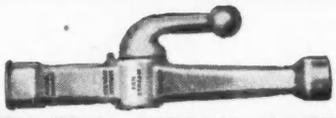


9:15 A.M. . . . Gasoline escaping at rate of 10 gallons per minute under 50 lb. pressure through three hacksaw cuts in pipe 13 ft. above ground is "touched off."

9:16 A.M. . . . After being allowed to burn furiously for a full minute, the *straight-stream* of the new Dual-Stream Nozzle of a No. 350-A Wheeled Extinguisher is directed at blaze.



9:17:05 A.M. . . . In just 65 seconds, this tough overhead gasoline fire (including blaze on ground) is OUT.



NEW DUAL-STREAM NOZZLE deals effectively with spill fires difficult to reach because of height or obstructions. Designed for use with DUGAS Wheeled Extinguishers, the new Dual-Stream Nozzle greatly increases fire-fighting range and effectiveness. A turn of the handle gives a *straight* stream with a range of 45 ft.—or a *fan* stream with a range of 15 ft.

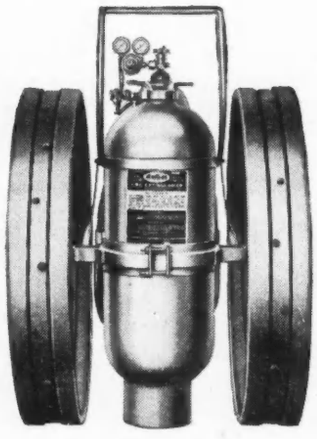
Quick Facts about DUGAS Dry Chemical

- For extra-hazardous fires involving flammable gases, liquids, greases or electrical equipment.
- Not an electrical conductor.
- Non-toxic, non-corrosive, non-abrasive.
- Not affected by extreme cold or heat.

Write today for complete information regarding DUGAS Wheeled Extinguishers with the New Dual-Stream Nozzle. . . and DUGAS Hand Extinguishers.

AN ANSUL PRODUCT
duGas
REG. U.S. PAT. OFF.
THE MASTER OF FLAME

Approved by Underwriters' Laboratories, Factory Mutual Laboratories



DUGAS 350-A WHEELED EXTINGUISHER

ANSUL CHEMICAL COMPANY, MARINETTE, WISCONSIN
DUGAS DIVISION

New Products for Aircraft

(*Continued from page* 57)

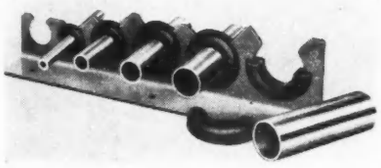
supercharger is used in the Cyclone 9HD to permit it to maintain power at higher altitudes than were attainable with former engines of the series.

Wright Aeronautical plans to produce the engine in four models which will have either single or two-speed supercharging and two alternate reduction gear ratios. All four models produce one hp for less than one lb of weight.

Simplified Fairlead

A simplified fairlead for electrical and other types of conduit offered by the Double T Fairlead Co., Hawthorne, Cal., consists of just two parts, the support and grommet.

Double T fairleads are designed to support tubing of the same size or any combination of sizes. When used on gang fairleads, any individual line or conduit may be removed without disturbance to the other lines in the same series.



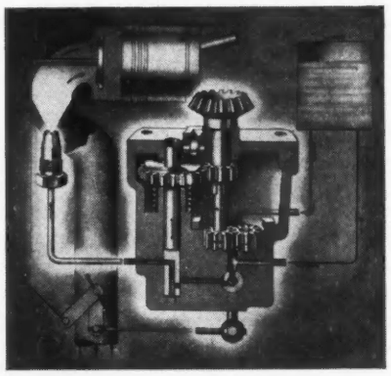
Double T fairlead

Having just the two parts, the bracket and the grommet, this new fairlead is extremely light in weight. All that is required to assemble is to place the split grommet over the tubing and then insert the other half of the grommet.

Gasoline Injection System for Small Aircraft Engines

A new gasoline injection system, to replace the carburetor generally used on small aircraft engines, is announced

(*Turn to page* 70, *please*)



Typical flow diagram and sectional view of Ex-Cell-O 4-cyl model injector.

Visit the Explosive Rivets Exhibit Space C-130 in the Arena—at the National Metal Exposition Cleveland—February 4 to 8, 1946

Fastening work is a one-man job with Explosive Rivets. Photo shows riveter attaching panel.

SEE EXPLOSIVE RIVETS IN ACTION AT THE METAL SHOW

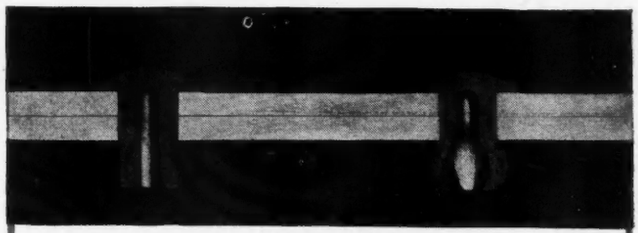
YOU'VE READ about Du Pont Explosive Rivets. Now see them at the Metal Show. Get the complete story... learn how easily these Rivets are inserted... how they simplify riveting in spots where solid rivets are difficult or impossible to use.

Demonstrators will show you typical applications for Explosive Rivets. They'll explain the simple, two-step method for installing these Rivets and answer your questions regarding types, sizes and materials in which they can be supplied.

We'd like to work with you—help you simplify your fastening operations. If you can't attend the Metal Show, send us a sample of your product, sketch or working drawing with specifications. We'll study the problem—advise how it may be done easier and quicker by using Explosive Rivets.

An Invitation: *If you are planning to attend the show. . . . bring along samples of materials used in your own manufacturing operations. Let us help you determine whether Explosive Rivets can do your fastening job better, quicker, more economically. No obligation, of course.*

E. I. du Pont de Nemours & Co. (Inc.) Explosives Department 146, Wilmington 98, Delaware.



Cross section of Explosive Rivets before and after expansion of charge in Rivet shank

DU PONT EXPLOSIVE RIVETS

DU PONT

REG. U. S. PAT. OFF.

by Ex-Cell-O Corp. of Detroit. Designed to meter mechanically the correct quantity of gasoline to the various engine cylinders, the system provides a positive control of the fuel-air mixture for best combustion.

The Ex-Cell-O system incorporates all of the advantages claimed for gasoline injection equipped planes over carburetor equipped planes. Of particular interest are the following: elimination of accidents caused by carburetor icing; equal distribution of fuel to all cylinders, reduced gasoline consumption and increased engine life through lowering of cylinder head temperatures; increased engine power and plane speed; smoother engine performance and better idling.

Westinghouse Approach Light

For use with radio blind-landing systems, a searchlight-type approach light for airports has been developed by the Westinghouse Electric Corp.

The new approach light uses a 19-in. reflector-lens system with a special 250-watt lamp. The main beam has over one and one-quarter million cp and is aimed directly along the path of the incoming plane. Auxilliary "fan beams" of over 100,000 cp reach from the ground to an angle far above any plane on the radio beam.

Mounted in long rows on each side of the approach zone, and spaced 500 ft apart in the rows, the new lights set up brilliant walls of light on each side of the approaching plane. As each approach light has about the same candle power as an airway beacon, the 2500-ft rows of light provide over a half-mile of direct visibility in the "soupiest" weather.

Continental Motors to Make Two New Products

Continental Motors Corp. will start production of a new Diesel engine line and a new hydraulically operated controllable pitch propeller as soon as tooling can be completed.

The Diesel engine line has been under development for several years and substantial orders already have been received. The propeller, developed by Continental Aviation and Engineering Corp., a subsidiary, is to made by the latter company in the government-owned plant in which operations were conducted during the war. Arrangements are being completed for leasing a portion of this plant for the propeller project and to manufacture parts and sub-assemblies for automotive and other manufacturers.

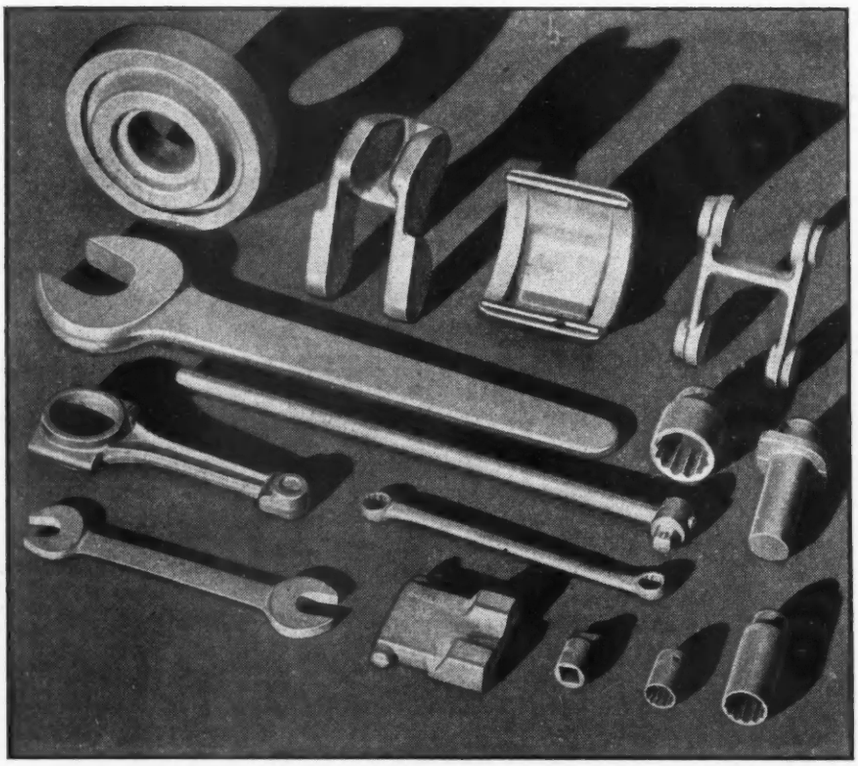
Advertising Note

Eugene W. Shafer has joined the San Francisco staff of the advertising firm of Wank and Wank to direct industrial advertising and marketing for the organization.

Small G-E Electrical Gyroscopes

These new General Electric advanced types of directional and climb-and-bank electrical gyroscopes held easily by the technician are tiny in weight as well as overall size in comparison with the gyros on the table which they replace. Each of the new-type electrically driven gyroscopes requires only 3¼ in. diameter of space on an airplane instrument panel. The new directional gyro weighs less than the one it replaces by more than one lb. The new bank-and-climb gyro weighs only 3½ lb.; the old one weighs 9 lb.

HERBRAND
DROP FORGINGS
—any size or shape up to 200 lbs.

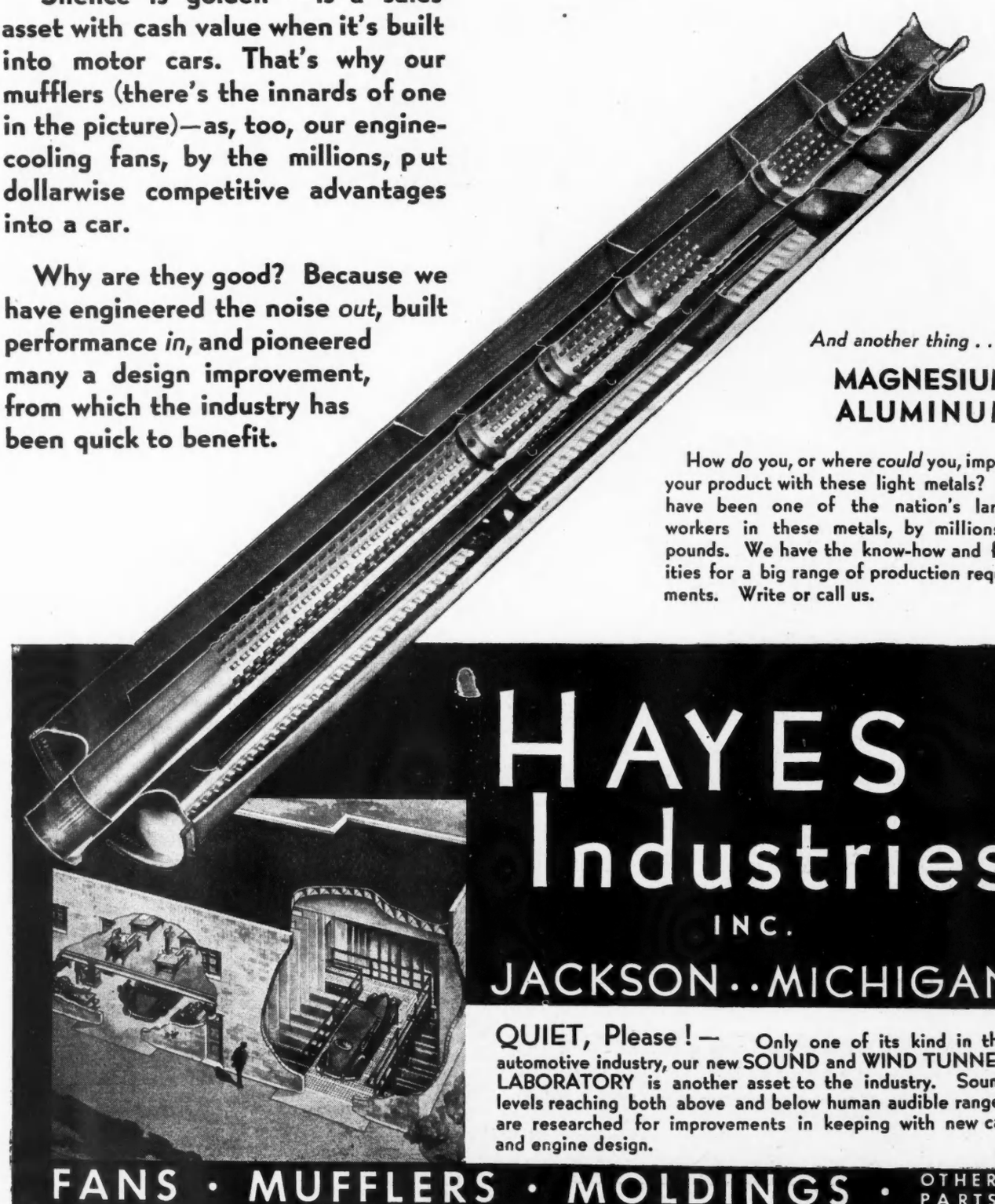


THE HERBRAND CORPORATION • Fremont, Ohio
Drop-Forged Tools Since 1881

QUIET, please!

"Silence is golden" — is a sales asset with cash value when it's built into motor cars. That's why our mufflers (there's the innards of one in the picture)—as, too, our engine-cooling fans, by the millions, put dollarwise competitive advantages into a car.

Why are they good? Because we have engineered the noise *out*, built performance *in*, and pioneered many a design improvement, from which the industry has been quick to benefit.



And another thing . . .

MAGNESIUM?
ALUMINUM?

How *do* you, or where *could* you, improve your product with these light metals? We have been one of the nation's largest workers in these metals, by millions of pounds. We have the know-how and facilities for a big range of production requirements. Write or call us.

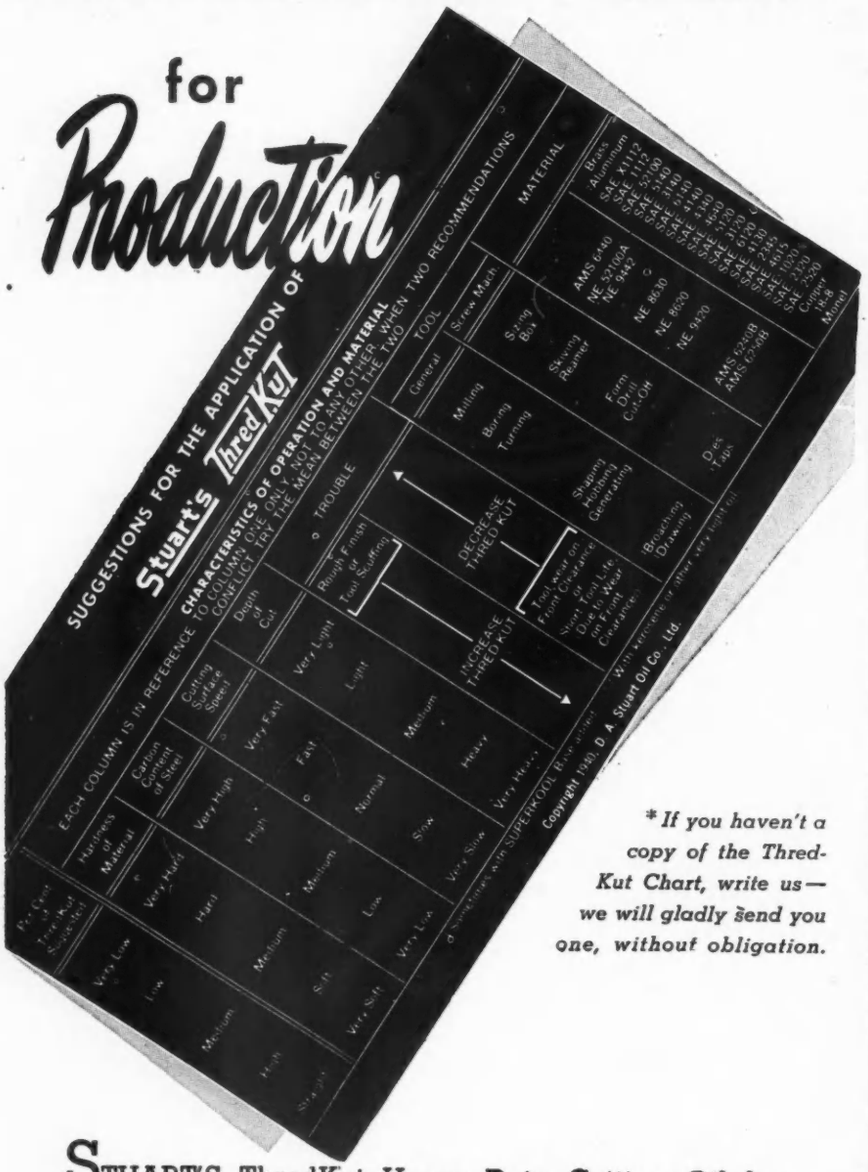
HAYES Industries
INC.
JACKSON . . MICHIGAN

QUIET, Please! — Only one of its kind in the automotive industry, our new SOUND and WIND TUNNEL LABORATORY is another asset to the industry. Sound levels reaching both above and below human audible ranges are researched for improvements in keeping with new car and engine design.

FANS · MUFFLERS · MOLDINGS · OTHER PARTS

INSURANCE POLICY

for *Production*


SUGGESTIONS FOR THE APPLICATION OF
Stuart's ThredKut
CHARACTERISTICS OF OPERATION AND MATERIAL
EACH COLUMN IS IN REFERENCE TO COLUMN ONE ONLY. NOT TO ANY OTHER. WHEN TWO RECOMMENDATIONS CONFLICT TRY THE MEAN BETWEEN THE TWO
MATERIAL
TOOL
TROUBLE
DECREASE THREDKUT
INCREASE THREDKUT
Copyright 1938, D. A. Stuart Oil Co., Ltd.

** If you haven't a copy of the Thred-Kut Chart, write us— we will gladly send you one, without obligation.*

STUART'S ThredKut Heavy Duty Cutting Oil has played an important part in solving many of industry's toughest metal working problems. Reference to the time-tested ThredKut Chart* has insured the proper application of this versatile product in many production emergencies. Alert production executives will find these aids of great help in answering troublesome metal-working problems. D. A. Stuart Oil Co., Ltd., 2733 S. Troy Street, Chicago 23, Illinois.

D. A. Stuart Oil CO.
LIMITED
ESTABLISHED 1865
Stocks in Principal Metal-Working Centers

Materials—Reconversion

(*Continued from page* 17)

steel mills have been getting only 40 to 60 per cent of normal supplies of semi-finished steel. Even if the steel strike is averted or only of short duration, the demand is so far in advance of possible supply that allocation among industries will be required, and automobile industry spokesmen are pessimistic about getting enough for anything like peak production.

Other shortages of automotive materials stem from the import situation. Domestic production of lead is steadily declining, according to Civilian Production Administration, and imports cannot be increased. There appears to be no threat to original equipment needs for lead at the moment, but the prospects for replacement batteries are not good. Tin also is in short supply, although reports of improved supplies are confused. CPA says that although the Japanese did no particular malicious damage to tin workings on the Malay peninsula, the equipment is in a bad state of obsolescence and disrepair, and that it will be 1948 before adequate production levels are reached. This pessimism is discounted by observers, however,

Additional evidence of shortages in certain materials is the re-imposition of inventory controls of some scarce items, such as tin, lead, and textiles. Under present regulations, companies affected by work stoppages are allowed to receive shipments of materials for the first 30 days of the strike. After that period, adjustments must be made so that accumulated inventory of most materials is adequate for only the first 45 days after production resumes. In the case of critical materials, however, only a 30-day inventory is allowed.

Another barrier to peak production in the next few months is the work still required in many automotive manufacturing and parts plants to fit them for high volume output. The prevailing impression has been that the plants are completely reconverted. That simply is not true. Most automotive assembly and parts plants are in production, of course, but that does not mean the whole reconversion job is finished. Much machinery and equipment still have not been delivered and considerable building, modernization, and other construction are not finished.

The prevailing opinion is that it will be at least June of this year before automobile production approximating that of prewar levels will be reached. That, of course, is only a general guess, since there are too many unpredictable factors to be reckoned with. The June estimate is predicated on the assumption that labor difficulties will be cleared up soon in the automotive and related industries and that the supply of materials now in short supply is increased.

GLOBALLY USED!

HANSEN COUPLINGS

THERE ARE DEFINITE REASONS for the world wide popularity of Hansen couplings.

Performance is what put them on top and this same remarkable performance is what is keeping them there. Make no mistake about this — no coupling on the market has the all 'round advantages of Hansen Coupling's. In buying, sound decisions rest on facts, check over these facts on Hansen Push Tite coupling before purchasing any coupling. It is compact, sturdy with all moving parts protected — it will and can take rough going. Its remarkable ABC simplicity in operation is unique. Simply push plug into socket, it is connected, air is automatically turned on. To disconnect merely slide sleeve back with thumb, it is disconnected and air is automatically turned off. No twisting or turning to connect or disconnect, no kinking of hose due to swivel action. It will take pressures as low as a couple of ounces up to a peak of over 10,000 pounds without leaking. No other coupling can match these features. There's a Hansen coupling made for air, oil, grease, oxygen, gasoline and acetylene and they come in a wide range of sizes. • • • Send for free industrial catalogs.

THE HANSEN MFG. COMPANY

1786 EAST 27th STREET • CLEVELAND 14, OHIO

Human Engineering

(*Continued from page* 39)

solve. When free men give up the task of trying to get along with each other, and pass the buck to Government, they surrender a substantial measure of their freedom.

This then, is the problem: In a free, competitive Democracy, mass production is a tool for raising the standard of living by reducing costs and thereby bringing more and better products within the budgets of more and more people. The problems of mass production have not yet been solved, for failure in human engineering is creating waste and inefficiency which handicaps the very purpose of mass production—lower costs. Workable solutions can be found if we will only bring to it the same insistent objectivity and willingness to experiment which industry has given to the mechanical difficulties in mass production.

In industrial human relations, then, there is a new and relatively unexplored frontier. Beyond this frontier lie opportunities, greater perhaps, than any can imagine. There are many considerations which must be taken into account in working toward a solution of this problem.

We do not want to destroy the unions. We want to strengthen their leadership by urging and helping them to assume the responsibilities they must assume if the public interest is to be served. It is clear, then, that we must look to an improved and increasingly responsible union leadership for help in solving the human equation in mass production. Union leaders today who have the authority to affect industrial production on a vast scale enjoy a social power of enormous proportions. If they are going to be real leaders they must accept the social obligations that go with leadership. What is needed today is industrial statesmanship—from both labor and management.

Modern man, who has done so much to reduce the manpower loss caused by disease, can certainly hope to reduce the manpower loss from industrial conflict. The public interest requires ways be found to eliminate industrial warfare without impairing or diminishing the rights which both management and labor must continue to enjoy.

There will always be some honest differences of opinion. But we can certainly deal with these controversies more wisely and efficiently. If we are to have industrial relations programs and labor relations staffs, and spend as much money on them as we do, we should do it expertly and efficiently, bringing to the task the same technical skill and determination that the engineer brings to mechanical problems. We must act on a more human and professional plane.

There is no reason, for example, why a grievance case should not be handled with the same dispatch as a claim for insurance benefits. There is no reason why a union contract could not be written and agreed upon with the same efficiency and good temper that marks the negotiation of a commercial contract between two companies.

In the meantime, there are day-to-day responsibilities of management toward employes which should fit into the whole pattern of the new relationships. Consider, for example, possibilities for improvement in personnel evaluation. Only recently have we begun to develop and use modern techniques which enable us to fit people to jobs, and fit jobs to people, with some degree of science.

When we have learned to do a reasonably good job of evaluating an employe's capacities at the start of his career, we can do a better job of upgrading. I am not referring to technical requirements having to do with such things as automatic pay raises and seniority, but rather to the development of more opportunities for employes to improve themselves in accordance with their own initiative and desires.

Communication between management

(*Turn to page* 76, *please*)

- Heavy bronze bearings
- 1" Collet capacity
- 11¼-inch swing
- Double-walled apron
- Large hardened and ground spindle
- Extreme accuracy
- Convenient controls
- Underneath V-belt motor drive
- All Steel Bench

. . . compare a SHELDON S-56 Precision lathe with all other 10" lathes in the moderate priced field, and you'll find more accuracy, more capacity, more convenience, more design, more quality . . . *from any angle just more lathe*

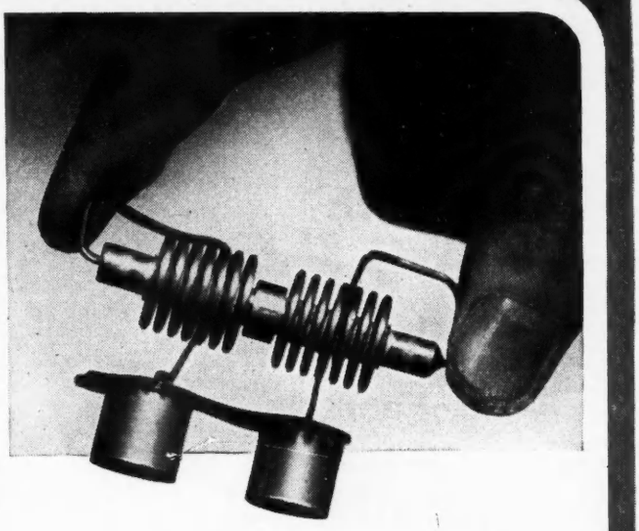
The SHELDON S-56 lathe has a bed length of 56", with rigid T-girted bed with 2 V-ways and 2 Flat ways which are ground and hand scraped to .0005" of both lateral and parallel alignment. Lead screws are cut on the finest Pratt & Whitney "super precision" lead screw machine. The S-56 lathe with 56" bed is mounted on a rigid 5 drawer steel bench (S-44 with 44" bed on a 4 drawer steel bench) which houses an efficient 4-speed (8 spindle speed) underneath motor drive. Each come with full quick change gears, power longitudinal and cross feeds and standard big lathe features.

SHELDON MACHINE CO., INC.
4220 N. Knox Ave., Chicago 41, U.S.A.
Builders of Good Lathes since 1919

How one metal made possible

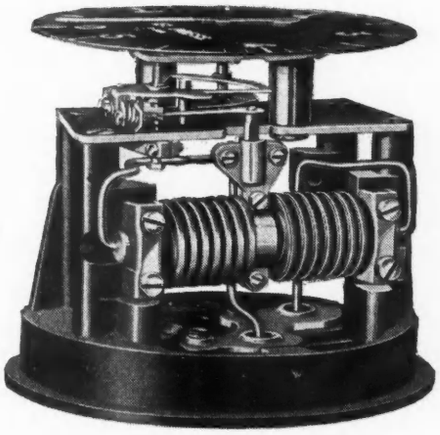
THIS NEW TYPE AIRCRAFT FUEL PRESSURE GAUGE

During the war, a new type fuel pressure gauge had to be developed for military aircraft that climb and dive at great speed and fly at extreme altitudes.



1—THE PRESSURE-SENSITIVE ELEMENT

There are no springs or diaphragms in the pressure-sensitive element of the new gauge. Instead, two metal bellows contract and expand according to variations in fuel and air pressure. Left-hand bellows receives the pressure of the fuel; right-hand bellows is open to the atmosphere.



2—THE ASSEMBLED GAUGE

Here's the completely assembled gauge, with cover removed. Note how the outside end of each bellows is rigidly restrained. All bellows' movements are transmitted to the central spacer, which in turn actuates the sector arm and needle.

Readings are in terms of actual fuel pressure above the existing air pressure. The gauge automatically subtracts atmospheric pressure from absolute pressure to give the pilot his fuel pressure in pounds per square inch *(Gauge)*.

3—THE DESIGN PROBLEM

Quick, accurate response to ever-changing air pressure is a "must." And with new aircraft able to climb almost a mile-a-minute, it takes a bellows of good design . . . and good metal . . . to smooth out the accompanying acrobatics of air pressure.

PICKING THE BEST METAL

On the basis of the required *mechanical* spring properties, several metals *could* have been used for the bellows. But an instrument of such high accuracy and hair-trigger response demanded more than that. The metal also had to supply the necessary strength . . . resistance to rusting and corrosion . . . resistance to corrosion fatigue. Moreover, the metal had to be available in the uniform gauges and tempers required.

INCONEL, an INCO Nickel Alloy, provided all these properties . . . *and more.*

32 BRAZED CONNECTIONS

That "*more*" was Inconel's workability. For fabrication of the tiny bellows unit (out of 1-in. wide, 0.010-in. gauge, half-hard temper Inconel strip) involved deep drawing . . . *and 32 brazed connections!*

Inconel filled the bill perfectly. And thanks to Inconel's excellent brazing qualities, less than one out of every thousand joints showed any leakage under test.

Whenever you need a hard-to-find combination of properties, remember the family of workable INCO Nickel Alloys. They'll help you fight stress . . . wear . . . fatigue . . . rust . . . corrosion . . . heat. For more information on Inconel, write for "Engineering Properties of Inconel." The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

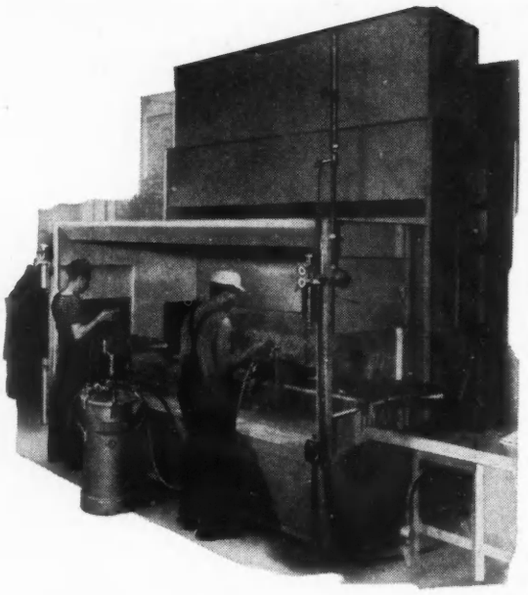
get to know all the

NICKEL INCO TRADE MARK ALLOYS

MONEL* • "R" MONEL* • "K" MONEL* • "KR" MONEL* • "S" MONEL* • INCONEL* • NICKEL • "L" NICKEL* • "Z" NICKEL*

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings . . . Welding Rods . . . (Gas and Electric) *Reg. U. S. Pat. Off.

TRIAD *PR* Cuts Spray Booth Clean-Up Time



White, non-glare coating of Triad PR improves visibility in the booth.

Clean-up time is reduced from hours to minutes when Triad PR is used on the sidewalls of wet or dry paint spray booths. Readily applied with a brush or spray gun, PR is quickly removed by water or steam along with all accumulated surface deposits.

Detrex field representatives can also supply scientifically compounded water conditioners to fit your individual wet spray booth set-up. Case histories, compiled by our representatives, have shown that PR and associated Triad spray booth compounds have cut "down-time" and maintenance costs in every installation in which they have been used.

DETREX CORPORATION
Detroit 27, Michigan

ALKALI CASE HISTORY

10. REMARKS: In removing Triad PR, two maintenance men spent 20 minutes cleaning a 125-foot canopy and two large spray booths and, in addition, prepared another batch of PR for respraying the cleaned areas. Formerly, when the company's own compound was used, it required one hour for five men to clean the canopy alone.

DETREX *Corporation*

DETROIT 27 • MICHIGAN

Solvent Degreasers • Metal Parts Washers • Processing Equipment • Industrial Cleaning Chemicals

and employes in large mass production plants is another important field in which we can work. In any large group of people working together it is a basic requirement that good lines of communication exist. There will always be plans and estimates, information about new styles and new engineering, and other data, which management must guard closely because they are the very elements on which tough competition is based. But information about company objectives and accomplishments should be made available to all. People want to know what the other people they work with are doing and thinking. They want to know "the score."

It is fairly easy for everybody to "know the score" when there are only 50 employes in a plant. But when thousands of employes work at assembly lines in a single plant they create a problem of communication which has not yet been solved.

In an age in which the world prides itself on speed and efficiency in human communication it is absurd that we should not have been more successful in this field. We have the tools at our disposal—movies, radio, coordination conferences, newspapers, the graphic arts, posters and all the rest. It is good business to see to it that the members of our industrial teams get information to make them conscious of the fact that they are on the team. This applies all along the line—shop employes, office workers, supervisory and executive personnel. Informed employes are more productive than uninformed employes.

There are other areas in which we can work toward better human engineering in mass production. The important thing, however, is to recognize the problem for the vital one it is, and to move forward in hope and confidence and intelligent experimentation toward workable solutions.

As a starting point for continuing efforts in that direction perhaps management and labor would today agree:

1. That the job of American Industry—management and labor—is to make at lower and lower cost more and better products to sell for lower and lower prices.

2. That the only way that job can be done is through understanding and sensible cooperation between management and labor.

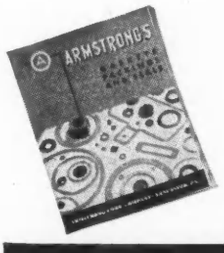
3. That the spirit of that cooperation must be a sense of joint responsibility. The public is the "Boss," not management and labor. Both labor and management must accept their share of responsibility to the public welfare and live up to their commitments.

4. That mass production has demonstrated its ability to bring high wages, and that higher wages can come only out of greater production and lower costs.

5. That, while no single human institution or industry can promise complete security because of the complexity of modern civilization, management and labor can work toward more certain, more stabilized employment.

6. That American industry should be a place of opportunity—a place in which men and women can grow and develop into better jobs.

TO SOLVE YOUR GASKETING PROBLEMS
. . . A THREE-POINT SEALING SERVICE
More than 50 resilient, stock sealing materials designed to handle even the difficult jobs
Materials made in forms and sizes to meet every need
Experienced, unbiased field assistance on your specific gasket problems



SEND FOR FREE BOOKLET. For descriptions of Armstrong's Sealing Materials, see Sweet's File for Product Designers. Or write us for your copy of the free booklet, "Gaskets, Packings, and Seals." Address Armstrong Cork Co., Gaskets and Packings Department, 1501 Arch Street, Lancaster, Penna.

ARMSTRONG'S
GASKETS · SEALS · PACKINGS

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Fiber Sheet Packings • Rag Felt Papers • Natural Cork

YOU CAN RELY on Armstrong's gasketing service for dependable, economical answers to your sealing problems because . . .

Each of Armstrong's more than 50 scientifically formulated stock materials is designed to meet a specific class of problems exactly. Each offers a tailor-made combination of physical properties. Thus, in most cases, you can meet your particular requirements with a stock gasket material from Armstrong . . . without delay and the expense of special compounding. Moreover, these materials are available in all needed forms . . . roll goods, ribbons, tapes, sheets, strips, extruded rings, molded shapes, and die-cut pieces.

With this wide-range line of materials to draw upon, your Armstrong Gasket Engineer can give you unbiased assistance. You'll find his suggestions sound because they're backed by 34 years of gasketing experience. During that time, we've solved practically every conceivable type of sealing problem involving temperatures ranging from minus 70° F. to plus 300° F. For quick, unbiased sealing service, call, write, or wire the Armstrong office near you. Or send us working drawings and details. No obligation, of course.

★ ★ ★

For same-day service on special die-cut gaskets, check with your near-by gasket cutter. Many leading cutters now stock Armstrong's specialized sealing materials.

NEW PRODUCTS

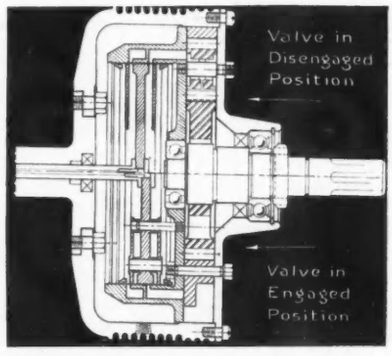
(*Continued from page* 52)

line. Such shock loads are cushioned by the automatic overload pressure release built into the unit and adjusted for a predetermined maximum pressure.

As illustrated, the power input shaft comes in through the cover or housing at the left, carrying at its extremity the axially slidable disk valve which is constrained to rotate with the assembly through fastenings in the side plate. The cover is bolted to the end plate, the latter carrying the pins for the planetary pinions and housing the outboard output shaft bearing. The sun gear is keyed or splined to the output shaft. The planetary gear set is encased by the gear body which has a close fit about all gears and is slightly thicker than the width of the gear face so as to permit of free rotation. Internal enclosure of the gear set is completed by the side plate. The latter is provided with suitable passages for connecting each oil pump to the valve body which is attached to form an integral part of the side plate. Passages are also provided for connecting the high pressure side of the pump for equalizing the pressure.

The drive is composed of two major elements—multiple gear pumps for circulating air when in neutral and oil for generating pressure; and the valve for controlling its operation. The two are interdependent. In the power unit, each planet gear, in combination with the sun gear, forms a hydraulic pump. The reservoir contains the oil, air, valve seat, and valve. In operation, the clutch while rotating on its longitudinal axis has a core of air in its central portion and a liquid annulus against the sides of the housing under the influence of centrifugal force.

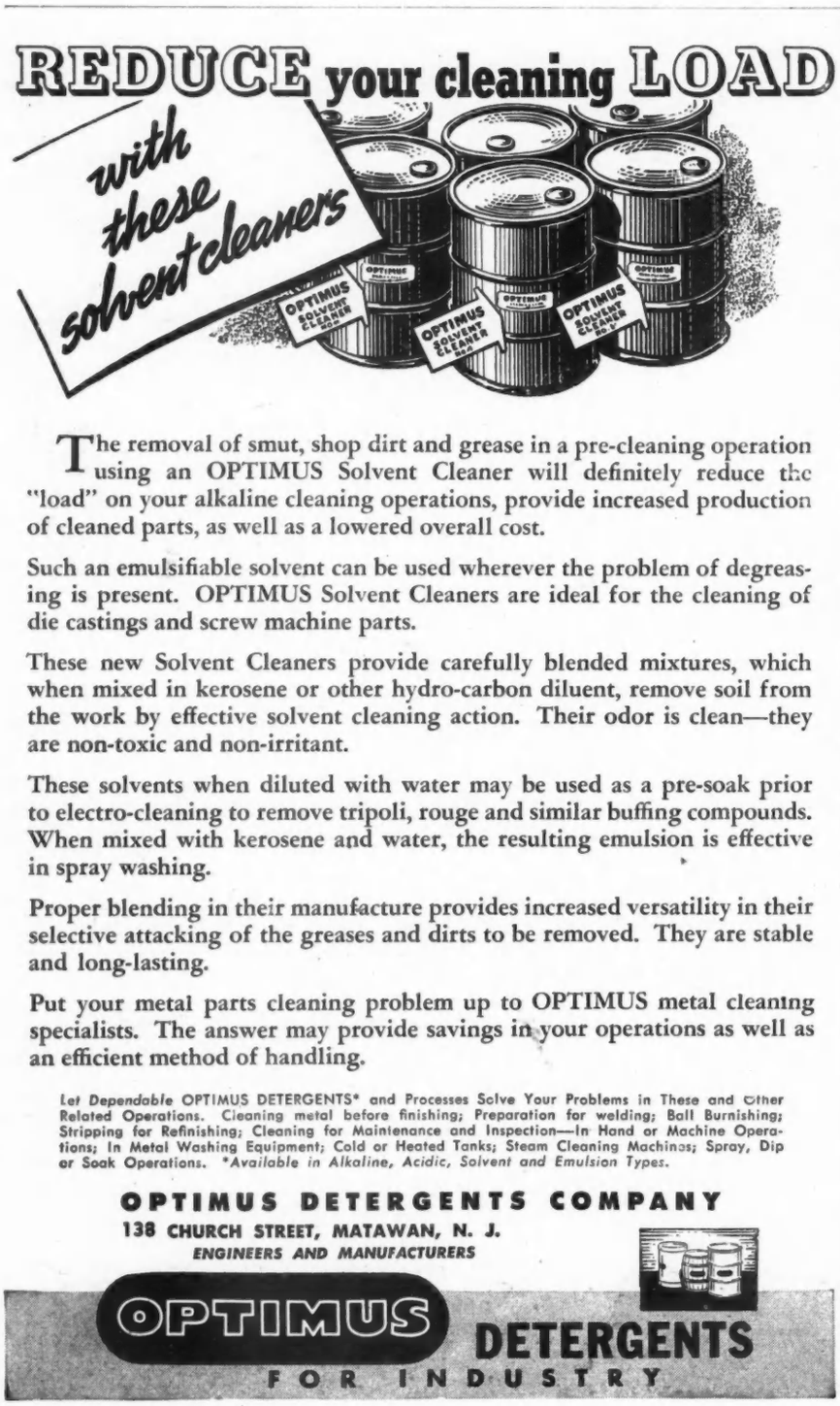
In a neutral position or when rotating at idling speeds, the output shaft is stationary since there is no pressure on the sun gear to which it is attached. The planetary gears simply turn about the sun gear in this phase. However, when a speed over 300 rpm is attained, there is sufficient centrifugal force to form the oil annulus in the reservoir while the entrapped air remains confined in the center. While the clutch remains disengaged the valve is so arranged as to baffle the oil from the inlet port. At this time the planet gears conduct the air by suction into the gear passages, and return it through the valve seat to the air core in the center in a process of continuous circulation. The gear body is provided with passages to all pressure ports so as to maintain a uniform balance of pressure under various conditions of loading.



Cross-section of Speed Flo Unit showing relative positions of the disc valve in neutral (disengaged) position and when fully engaged (lower section). As shown, the power input shaft is at the left; the output shaft at the right. The output shaft is rotated by the sun gear to which it is keyed.

As the valve is moved to its engaged position, the circulation of air is gradually diminished while the liquid is permitted gradually to enter the circuit. This phasing of the inlet port varies the density of the fluid admitted to the oil pump. Movement of the valve

(*Turn to page* 80, *please*)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with these solvent cleaners
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Let Dependable OPTIMUS DETERGENTS* and Processes Solve Your Problems in These and Other Related Operations. Cleaning metal before finishing; Preparation for welding; Ball Burnishing; Stripping for Refinishing; Cleaning for Maintenance and Inspection—In Hand or Machine Operations; In Metal Washing Equipment; Cold or Heated Tanks; Steam Cleaning Machines; Spray, Dip or Soak Operations. *Available in Alkaline, Acidic, Solvent and Emulsion Types.
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The removal of smut, shop dirt and grease in a pre-cleaning operation using an OPTIMUS Solvent Cleaner will definitely reduce the "load" on your alkaline cleaning operations, provide increased production of cleaned parts, as well as a lowered overall cost.

Such an emulsifiable solvent can be used wherever the problem of degreasing is present. OPTIMUS Solvent Cleaners are ideal for the cleaning of die castings and screw machine parts.

These new Solvent Cleaners provide carefully blended mixtures, which when mixed in kerosene or other hydro-carbon diluent, remove soil from the work by effective solvent cleaning action. Their odor is clean—they are non-toxic and non-irritant.

These solvents when diluted with water may be used as a pre-soak prior to electro-cleaning to remove tripoli, rouge and similar buffing compounds. When mixed with kerosene and water, the resulting emulsion is effective in spray washing.

Proper blending in their manufacture provides increased versatility in their selective attacking of the greases and dirts to be removed. They are stable and long-lasting.

Put your metal parts cleaning problem up to OPTIMUS metal cleaning specialists. The answer may provide savings in your operations as well as an efficient method of handling.

Let Dependable OPTIMUS DETERGENTS* and Processes Solve Your Problems in These and Other Related Operations. Cleaning metal before finishing; Preparation for welding; Ball Burnishing; Stripping for Refinishing; Cleaning for Maintenance and Inspection—In Hand or Machine Operations; In Metal Washing Equipment; Cold or Heated Tanks; Steam Cleaning Machines; Spray, Dip or Soak Operations. **Available in Alkaline, Acidic, Solvent and Emulsion Types.*

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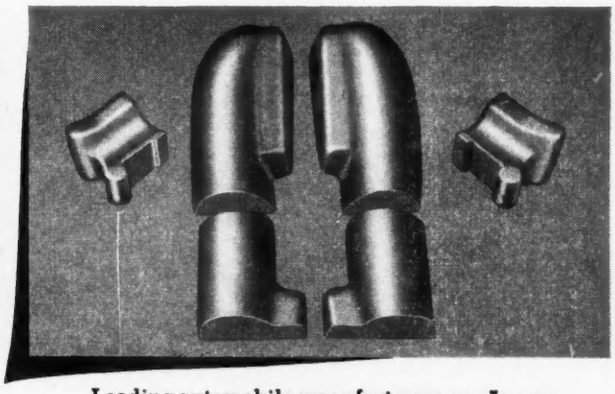
OPTIMUS DETERGENTS FOR INDUSTRY

EXCEPTIONALLY SUCCESSFUL IN CAST-TO-SHAPE WORK

JESSOP 3-C SPECIAL



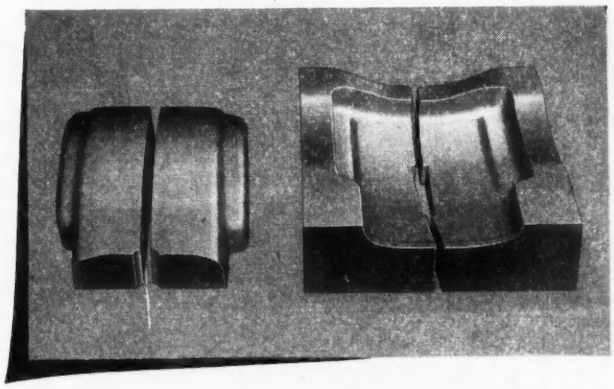
Leading automobile manufacturers use Jessop 3-C Special for Fender Guard Punches.

Phenomenal resistance to wear and abrasion, as exhibited by Jessop 3-C Special, renders this steel an outstanding achievement for Cast-to-Shape tool and die work. By improved induction melting, under constant metallurgical control, an exceptional quality is developed that is ideal for long production runs.

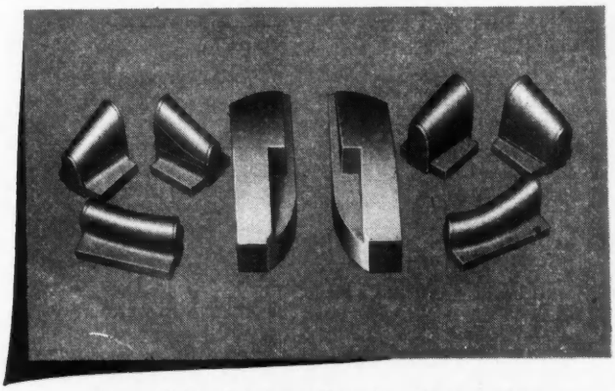
Jessop Cast-to-Shape tool steel, made to 3-C Special analysis, lends itself exceptionally well to casting to shape. The most intricate shapes are possible, and tools and dies can be placed in production with a minimum loss in time and machining costs. In many instances the elimination of as much as 60% of machining time is possible, which also results in an additional economy in material.

Jessop 3-C Special is an air-hardening tool steel recommended unreservedly for general stamping, forming, drawing, trimming, and blanking work, including ceramic dies, brick moulds, tile liners, etc. On long, difficult, and exacting work it does a great job because of its resistance to abrasion and retention of high polish throughout the life of the tool or die.

Can you afford to overlook this means of improving your competitive position in the tool and die industry now that keener competition threatens? Cast-to-Shape steels can meet your particular needs. Write for full information on Jessop 3-C Special. Ask also concerning oil- and water-hardening tool steels, special hot work, heat-resistant, and stainless steels.



Automobile Fender Guards, Punches and Dies.



Automobile Bumper Guards, Punches and Dies. Detail comes through with accuracy that eliminates machining.

JESSOP STEEL COMPANY

HEAD OFFICE AND WORKS: WASHINGTON, PENNA.

toward the engaged position gradually closes the discharge port causing the gear pumps to build up pressure on the sun gear, thus producing a tendency to rotate. When the valve is in fully engaged position, the oil pressure on the sun gear causes full engagement and rotation as a unit up to its capacity. In intermediate stages there will be relative movement between the sun gear and the planetary gears in inverse proportion to the pressure built up by valve position.

It is said that the pressure in the circuit will always balance the load on the output shaft. As the condition of maximum torque is approached, the output shaft rotation approaches the speed of the input shaft. The rate of engagement may be regulated—fast or slow—depending upon the requirements of the installation.

The manual clutch control may be operated by foot or hand lever. For more sensitive control a screw thread operated by hand is commonly used.

Refillable Pencil Prevents Breakage of Lead

A refillable draftsman's pencil, designed to eliminate the annoyance of broken lead, is offered by the Charles Bruning Co., Chicago, Ill. The Bruning No. 3583 draftsman's refillable pencil is constructed on an entirely new principle. A clutch holds the lead firmly in a non-slip rubber grip that prevents the nicking and scoring of lead which cause breakage.

This new refillable pencil is especially designed for engineers and draftsmen.

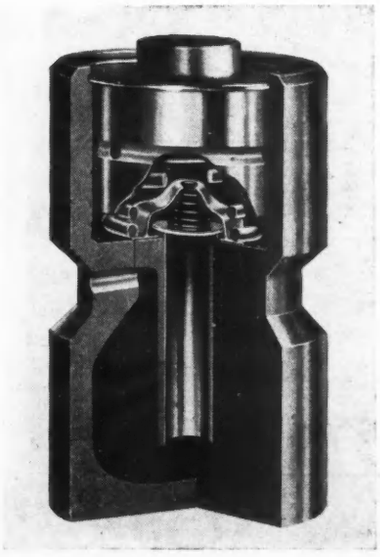
Bruning No. 3583 draftsman's refillable pencil

Its long barrel permits the use of any full-length standard drafting lead, from .079 in. to .070 in. which includes HB and 9H. The grip is knurled to provide a firm hold and to prevent slipping.

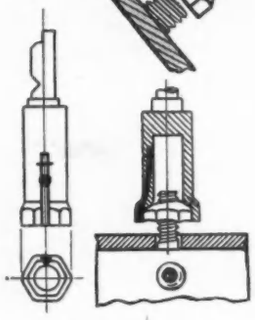
Automatic, Self-Adjusting Hydraulic Valve Tappet

An automatic, self-adjusting hydraulic valve tappet has been produced by Johnson Products, Inc., Muskegan Heights, Mich. It is available in either the mushroom or barrel form and is designed to operate with zero clearance. With slight modifications in the cam form of the normal camshaft, it is claimed that the use of Johnson tappets will provide a quiet running engine,

(*Turn to page 82, please*)



Hydraulic valve tappet made by Johnson Products, Inc.



This Palnut Socket for Yankee and power drivers has a spring finger which holds Palnuts securely in socket while starting them on thread and tightening to locked position.

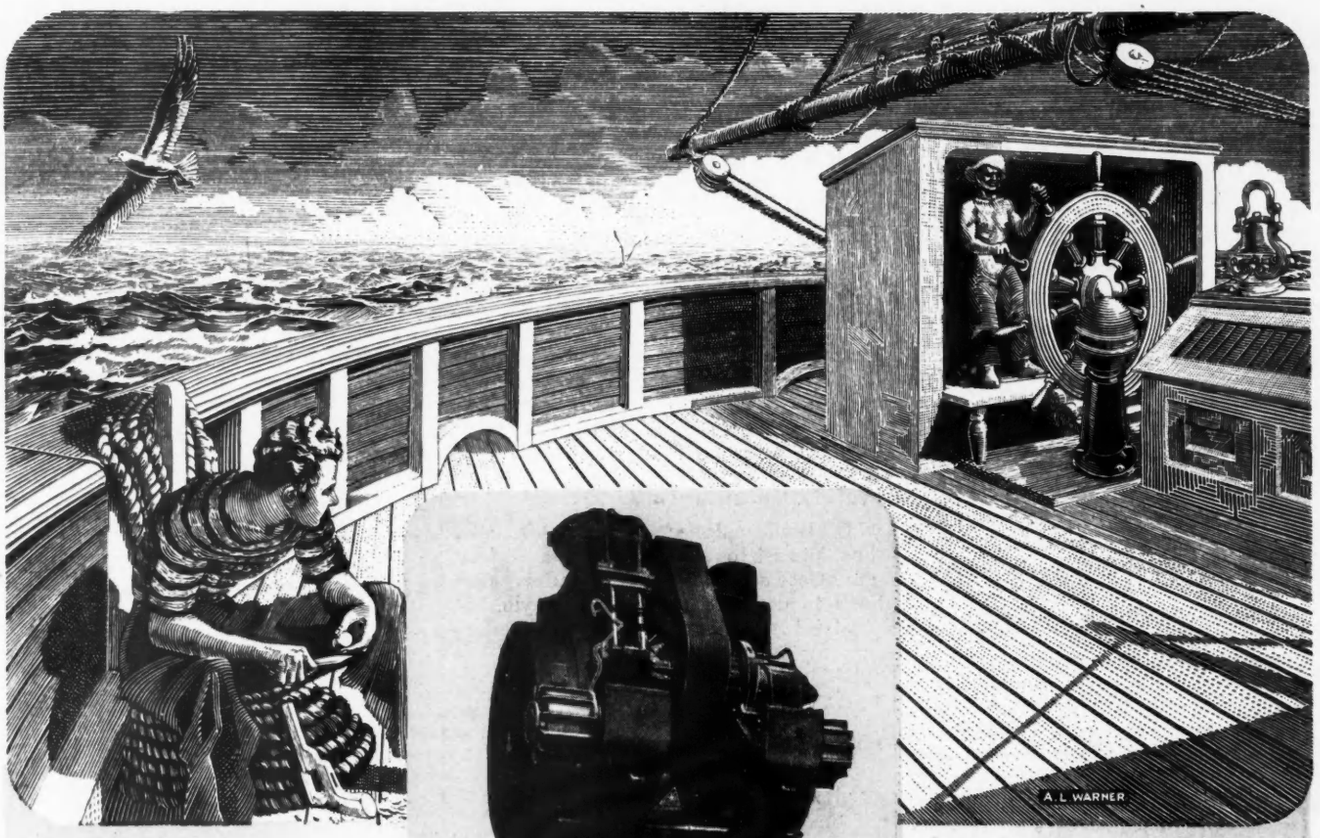
● Self-locking PALNUTS are great time-savers on fast assembly lines. By using a Palnut socket attachment in your power drivers (or Yankee drivers), Palnuts can be run on speedily in any position, whether driver is vertical or horizontal.

Palnuts lock as they tighten, eliminating need for regular nut and lockwasher. One part is handled, instead of two, further reducing assembly time, as well as cutting costs.

Self Locking Palnuts are inexpensive, single thread, spring tempered steel locknuts, which exert a powerful double locking action that resists vibration. Many types for various applications, in a wide range of standard sizes.

Send details of assembly for samples. Write for Palnut Manual No. 2 giving full engineering data.

THE PALNUT CO., 60 Cordier St., Irvington 11, N.J.



HE MADE ONE DO THE WORK OF SIX

In 1835 Samuel Colt finally solved the problem that had puzzled gunsmiths for decades. Colt's contribution was a practical mechanism for accurately turning and indexing a revolver's six chamber cylinder. This he conceived as a Clipper ship sailor, after watching the operation of the ship's steering wheel ratchet.

By improvement and practical change of a conventional design, Colt thus replaced the older single shot pistol with the far more efficient six shot revolver.

Clearing's contribution to industry has a parallel to the story of Colt. Because of new and practical engineering elements not found in conventional press design, Clearing Presses have often provided faster operation, broader application, or greater accuracy. Clearing engineering has been and remains keyed to all industrial developments, whether they involve new product design, new materials, or new methods.

Investigate how Clearing Presses might be applied to your production needs. Your inquiry is invited.

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MECHANICAL AND HYDRAULIC PRESSES
FOR SUCH OPERATIONS AS DRAWING + BLANKING + FORMING + FORGING

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The Master
RUST PREVENTIVE

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Now:

NOX-RUST
CLEAR COAT

forms a

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Protective Film

Against RUST!

The perfect rustproofing where high-grade protection, transparency, and non-removability is the aim.

CLEAR COAT comes in light, medium and heavy consistencies. Forms a highly adhesive, dry coating . . . The lightest grade of CLEAR COAT is practically invisible. Identification markings show through plainly.

NOX-RUST CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS

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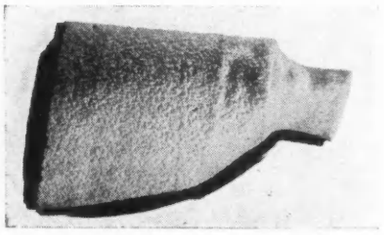
improved valve life, and an increase in power in some cases.

The tappets are arranged to utilize the oil of the engine lubricating system, either at standard pressure or at reduced pressure. As illustrated, the valve separating the hydraulic chamber from the oil reservoir is of flat disc type and contacts a flat seat. It is contained in a pressed steel retainer and may be removed conveniently for cleaning if necessary. The unit is installed with the piston up and in contact with the valve stem or the push rod in the case of overhead valve engines.

Safety Gauntlet-Cuff

C. Walker Jones, Philadelphia, Pa., has placed on the market a safety gauntlet-cuff that is said to afford savings to users of the gauntlet-style, industrial gloves. The Jomac gaunlet-



Jomac gauntlet-cuff

cuff is a separate piece—extra-strong covering for the forearm. When the gloves themselves become worn, they may be replaced, retaining the Jomac gaunlet-cuff, which fits snugly at the wrist around the new glove.

New Heat-Treatable Stainless Steel

Carnegie-Illinois Steel Corp., United States Steel Corp. subsidiary, offers to the trade Stainless "W," a new heat-treatable stainless steel of the 18-8 type which makes available the high strength and corrosion resistance of 18-8 in all wrought and cast forms, regardless of size or shape. In this new steel, developed and now made public for the first time, the basic composition is so balanced as to insure, without the necessity of cold working, the approximate completion of the austenite-ferrite (martensite) transformation and the subsequent process of precipitation hardening.

In the annealed condition Stainless "W" ordinarily has a hardness of 22/28 Rc, a tensile strength of 120,000/150,000 psi, and a yield strength of 75,000/115,000 psi. By proper heat treatment the hardness can be raised to 39/47 Rc, the tensile strength to 195,000/225,000 psi with a yield strength of 180,000/210,000 psi.

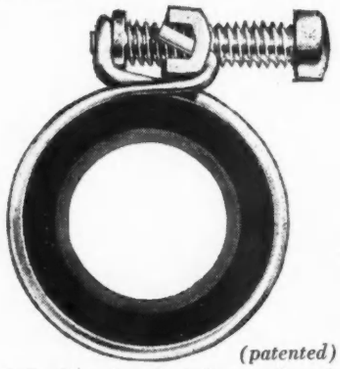
Many applications are foreseen for this new steel, particularly in bar form. It is producible in all forms for com-

(*Turn to page* 84, *please*)

Ripley take note...

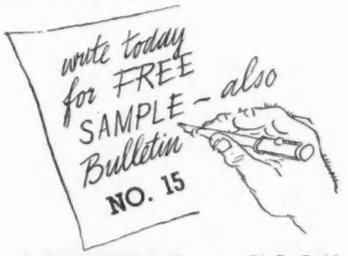
. . . believe it or not . . . here's a wire hose clamp that tells Mr. Hose . . . "You can't leak any more, any more." It encircles the hose with a steel-vise grip at every point of its 360° circumference, and NEVER lets go!

Manufacturers, Mechanics, Owners . . . take notice. The Central "360" Wire Hose Clamp is sold with an unconditional guarantee that it will do its job — no "clinches" barred!



(patented)

P.S. No shock, jolt or vibration can lessen or loosen the powerful grip of the "360" clamp. Costs no more . . . but worth much more.

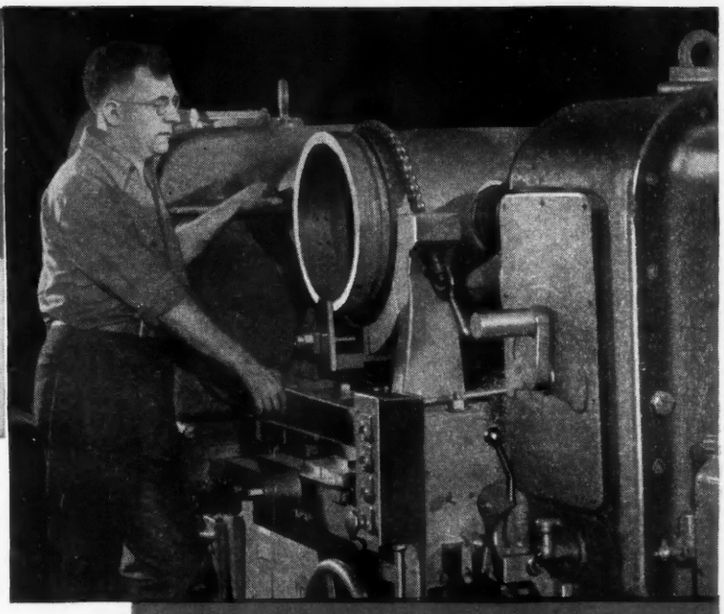


CENTRAL "360"
WIRE HOSE CLAMP
CENTRAL EQUIPMENT CO.
900 S. WABASH AVENUE. CHICAGO 6, ILL.

112¼ MINUTES Saved

IN BORING WRIST PIN HOLES

Rough and Finish Boring, Counterboring, and Facing Operations Combined in One Barnes Machine

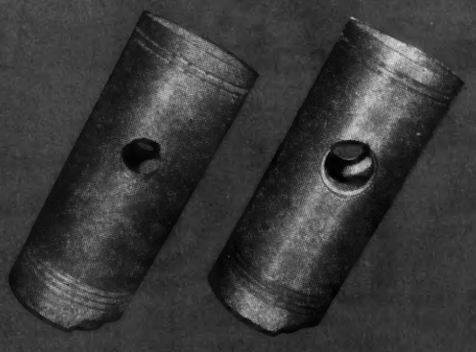


Designed especially for this boring application, this Barnes machine not only reduces machining time, but also produces an excellent finish.

● In 57¾ minutes, as compared to 230 minutes on another type machine, wrist pin holes, in engine pistons, are rough and finish bored, counterbored, and the inside bosses of the wrist pin holes faced and chamfered on this W. F. and John Barnes Duplex Boring Machine.

In the first operation, two 5.375 diameter holes, diametrically opposite, are rough bored. In finish boring, one hole is bored to 5.750" diameter, $^{+.001"}_{-.000"}$ while the other hole is finish bored to 5.500" diameter, $^{+.001"}_{-.000"}$ Both heads on the Barnes machine bore simultaneously.

The W. F. and John Barnes Duplex Boring Machine on this job is equipped with standard hydraulic sliding head units, with single spindle boring heads. A manual shift is used to change speeds. The workpiece is held in a special fixture, mounted on a heavy-duty fixture base. A handwheel traverses the fixture in either direction for facing operation and a longitudinal micrometer adjustment is provided to facilitate tool setting.



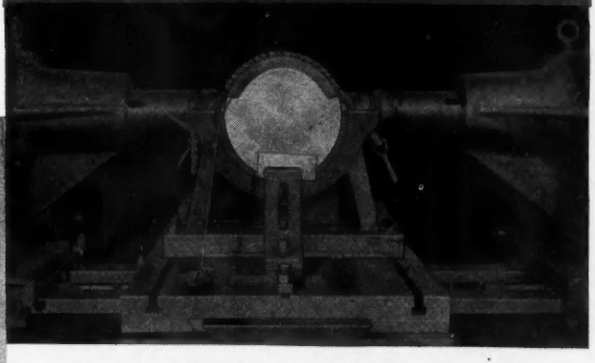
Diesel Engine Pistons before and after boring and facing operations.

TO GET BETTER METAL WORKING PRODUCTION

W. F. and John Barnes design and construct Special Machine Tools which produce more at less cost. Each Barnes Unit-Type and Special Machine does more work and does it more efficiently than the machine previously used for the same operations. Built from standard hydraulic feed and drive units, Barnes Special Machine Tools for DRILLING, BORING, REAMING, TAPPING, FACING and MILLING will give you higher production, with savings in time and floor space; and more accurate work with better finish.

If you have metal working production problems, qualified Barnes engineers will suggest Unit-Type or Special Machines to suit specific jobs, and show you the proper methods and procedures in securing more all-round economy. Avail yourself of this free consultation service.

Schematic layout showing facing cutter in bar driven by one spindle and piloted in opposing spindle.



Close-up of Diesel Engine Piston in fixture designed and furnished by customer.

Here's Information

. . . Barnes "SPECIAL MACHINE TOOLS" Book No. 146 contains Performance Data Stories describing many different types of metal working jobs. Your copy will be sent, without obligation, when requested on company letterhead.

W. F. & JOHN BARNES

W. F. and JOHN BARNES

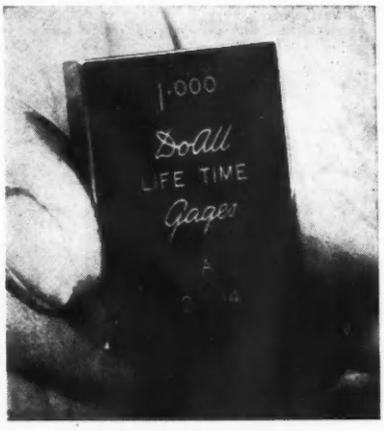
312 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

mercial use, and of particular interest is the fact that it exhibits considerably less directional properties than cold worked 18-8. Although this new steel is stiff to work, it can be subjected to drawing operations and given an intermediate anneal as often as desired in the course of deep drawing and then heat treated to develop the desired high physical properties in the whole piece.

Stainless "W" can be rolled into billets, bars, sheets or shapes, drawn into wire or pierced for tubing, or it may be forged as desired into any shape or size, the finished product being amenable to heat treatment to develop the desired hardness in addition to corrosion resistance superior to that of the heat-treatable straight chromium steels and approximately the same as that of 18-8 stainless steels in most corrosive media.

DoAll Lifetime Gage Blocks

The DoAll Co., Minneapolis, Minn., has introduced a new line of gage blocks, the DoAll Lifetime gage blocks. These gage blocks are made of —or faced with—DoAlloy, a wear resistant alloy having the same expansion characteristics as steel. This makes possible their use under any temperature conditions whether in the shop, tool room or inspection department.



DoAll gage block

These blocks are accurate for dimension, flatness and parallelism.

Their stability is due to the unique heat treatment and the character of the alloy. They will remain flat under severe temperature changes and will retain their accuracies even though subjected to temperature of —120 F to 500 F. In addition to the improved heat treatments through which these blocks are carried, they are also subjected to a DoAll stability treatment, being frozen to sub-zero temperatures and then heated through a series of cycles.

All blocks whose dimensions are .250 in. or smaller are of solid DoAlloy. Blocks from .300 in. and larger are faced with DoAlloy on their wear surfaces.

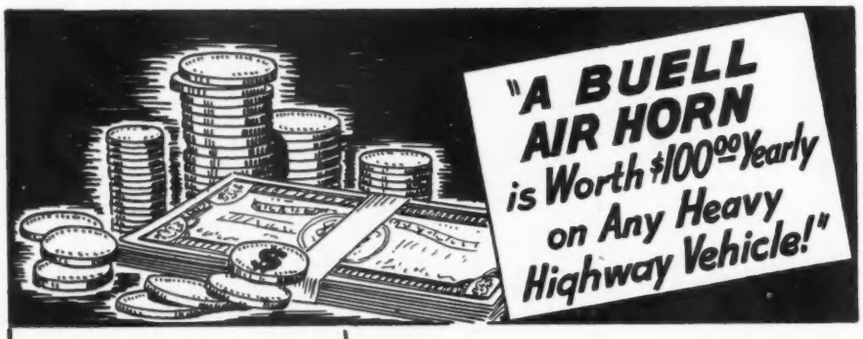
Packaged Air Conditioning Unit

The Curtis Manufacturing Co. of St. Louis, Mo., has brought out an improved model of its Packaged air conditioning unit. This Curtis air conditioner provides a complete air condi-

(*Turn to page 86, please*)

Vitrified-Bonded Diamond Abrasive Wheels

The line of resinoid-bonded and metal-bonded diamond abrasive wheels made by Bay State Abrasive Products Co., Westboro, Mass., is now supplemented by vitrified-bonded wheels in a wide range of standard shapes. The maker states that the new bond provides great strength and rigidity, plus faster, cooler cutting action.



- Buell Air Horns are tops in warning signal efficiency.
- Installed as original equipment on many Trucks and Buses.
- They reduce maintenance costs by decreasing stops, starts and slow-downs.
- All records prove that they save tires, brakes, clutches and gears.
- Cut gas and oil consumption.

Sturdy, Powerful Toned Horns— Built for Service!

A Buell Air Horn is worth $100.00 yearly on any heavy highway vehicle. With a Buell the driver has greater security, maintaining a steady cruising speed. Slowing a 20 ton load from 50 MPH to 30 MPH means destroying a lot of energy thru brake lining and *tires*. It is replaced by burning more gasoline, increasing load on engine, and *tires* again, to regain speed. This all costs money. We believe $100.00 yearly is a low estimate. Then remember a Buell will last more than 10 years. How would you rate a $100.000 investment that earned $100.00 yearly for 10 years. Ask the man who has a Buell.

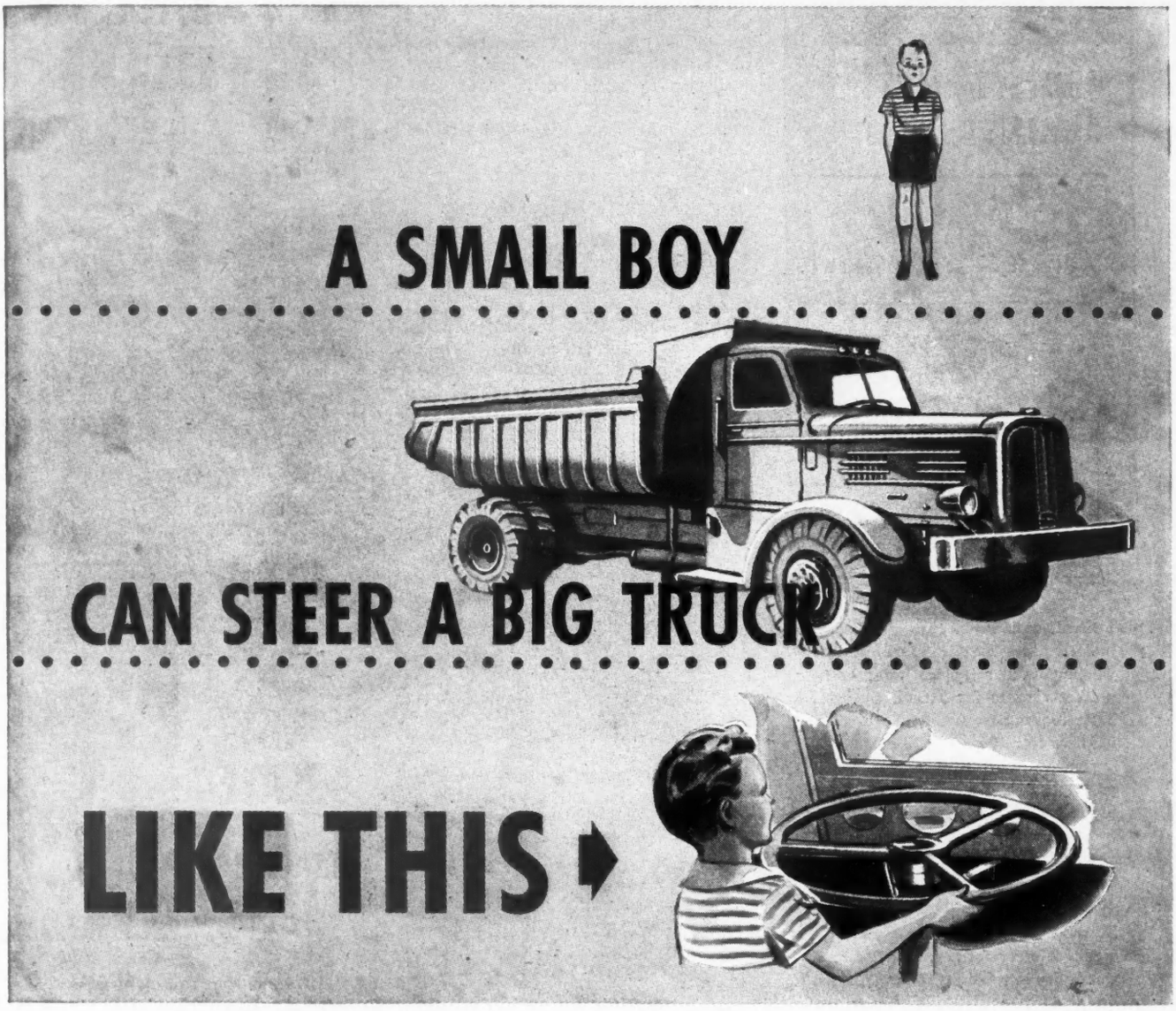
BUELL AIR COMPRESSOR

- Used on Passenger Cars, Trucks, Buses, Boats and Planes.
- Small and compact in size . . . efficient and powerful in action.

Buell engine-driven compressors supplied air to operate air brakes in thousands of R.C.A.F. aircraft. Only a combination of quality and precision workmanship could meet the requirements of this type of service.

Designed for compactness and light weight, they are far more efficient and powerful than their size indicates. Let us prove their adaptability to your needs.

BUELL MANUFACTURING CO.
2975 COTTAGE GROVE AVE., CHICAGO 16, ILL.

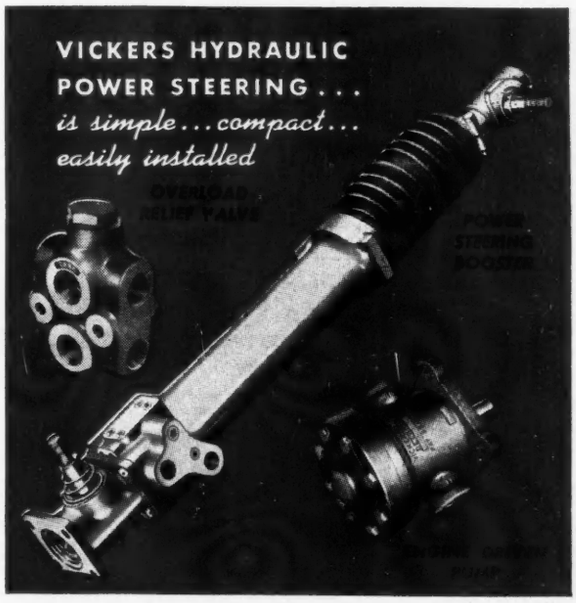


with VICKERS Hydraulic POWER STEERING

We don't expect a small boy to drive a big truck, but his strength is many times equal to the steering effort required if the truck has Vickers Hydraulic Power Steering. The steering wheel turns with effortless ease, and the front wheels always follow *exactly*.

Moreover, no matter how rough the ground, no road shock can get to the driver. The steering wheel cannot spin, or jerk—the vehicle can be driven over the curb or through sand with no "fight" from the wheel. A flat tire will not cause swerving. The driver is relieved of the most fatiguing part of his job—enabling him to work faster and longer with greater safety.

Vickers Hydraulic Power Steering is simple, compact, easy to apply to existing chassis designs. It has automatic protection against abuse and excessive steering reaction forces. Lubrication is automatic. Fifteen years of successful operating experience on trucks, buses, road machinery, etc. have proved the value of Vickers Hydraulic Power Steering. Write for Bulletin 44-30.



VICKERS *Incorporated*

1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD
TULSA • WORCESTER

PROTECT PARTS AGAINST RUST

the new low-cost way with

OAKITE PROTECTIVE OIL

Drilled, machined, ground or sand-blasted parts that are marking time waiting further fabrication present perfect targets for attack by rust. Effective counter measures are called for here to reduce rust rejects . . . to insure that subsequent production proceeds in a smooth, trouble-free manner. You can get positive parts protection from rust by using that newly developed rust-preventive Oakite Special Protective Oil.

Method of application is simple . . . quick. Merely immerse parts either wet or dry in tank containing Oakite Special Protective Oil solution. Moisture, where present, is immediately dispelled . . . a thin, transparent protective coating of oil forms to guard surfaces against rust attack.

TECHNICAL DATA FREE!

Specially prepared 16-page booklet fully describes Oakite Special Protective Oil . . . offers many suggestions on a wide variety of useful applications such as protecting stored tools and parts from indoor rust; neutralizing fingerprints. Send for a FREE copy of the booklet or ask for an in-plant demonstration TODAY! No obligation.

OAKITE PRODUCTS, INC.
28A Thames Street, New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

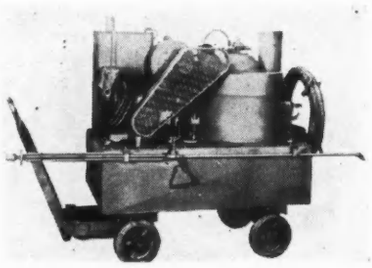
OAKITE *Specialized* CLEANING
MATERIALS • METHODS • SERVICE

tioning system in one compact unit, which cools, dehumidifies, circulates, and filters the air. It can be adapted for heating and humidifying also, if desired. Installation is said to be simple—requiring only electrical and water connections. It is available in 3 and 5-ton capacities.

New Steam Cleaning Unit

Oakite Products, Inc., New York, N. Y., has developed a multiple-duty steam cleaning unit known as the Oakite-Vapor cleaning unit.

This unique unit is a self-contained, down-draft flame, oil-fired, enclosed coil-type steam generator that delivers hot vaporized cleaning solutions under selective pressures up to 200 psi for the removal of grease, grit, grime, paint and other deposits from surfaces.



Oakite-Vapor cleaning unit

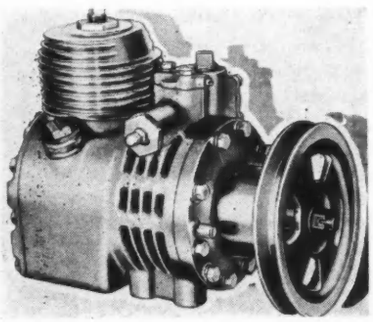
A wide range of fuel oils such as No. 1, No. 2 or No. 3 fuel oil, kerosene or gasoline, may be used to operate the unit. Due to its flexibility of steam pressures, the unit may be used on many different types of light and heavy-duty cleaning.

Improved Air Compressor

The Wagner Electric Corp., St. Louis, Mo., has recently improved its rotary air compressor. An efficient oil filter with easily replaceable filtering element has been added. Bearing capacity has been increased. Inlet and discharge air passages have been enlarged and streamlined to increase the volumetric efficiency of the compressor.

An improved type of rotary shaft seal has been incorporated which is

(*Turn to page* 88, *please*)



Wagner rotary air compressor

This is a B. F. Goodrich

RIVNUT

RIVNUTS are unique among blind fasteners. You can fasten *with* them . . . you can fasten *to* them. They're the only simple, one-piece blind fasteners that have this important dual use!

There are many other advantages that make Rivnuts the ideal solution to many tough fastening problems. They're light yet strong, low-cost, ready for use as received, and so easy to install even a blind man can do it.

Rivnuts are available in aluminum, brass . . . and now STEEL! Full range types, sizes and grips for use in metal, plastics, wood.

FREE! 40-pg. Data Book

This is the whole story . . . a complete and convincing demonstration of Rivnuts' outstanding advantages. Get a copy and see for yourself why these fasteners deserve a place in your plans. Address The B. F. Goodrich Co., Dept. AI 1-15, Akron, O.

The modern facilities developed for the production of N-A-X Armorplate are now meeting peacetime requirements

Designed and installed for the production of N-A-X Armorplate, this special heat-treating unit gives Great Lakes Steel Corporation facilities for supplying you with alloy sheets and plates fully heat-treated (quenched and drawn) to a wide range of high physical properties, constantly uniform in hardness and flatness. Pre-heat-treated N-A-X alloy sheets and plates can be supplied in thicknesses of ⅛″ to 1″; in widths of 6″ to 72″; and in lengths up to 336″. For complete information, write:

GREAT STEELS FROM GREAT LAKES

GREAT LAKES STEEL
Corporation

N-A-X ALLOY DIVISION • DETROIT 18, MICHIGAN
UNIT OF NATIONAL STEEL CORPORATION

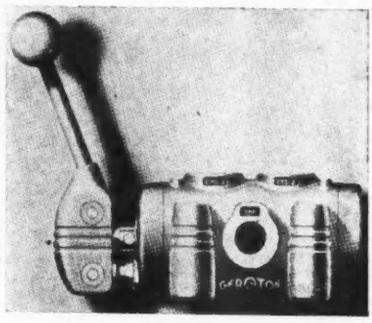
easily accessible. Cooling of the compressor has been improved by the addition of exterior fins to increase air cooling, and the use of a heat exchanger type and plate to increase water cooling. Improved oil economy has been accomplished by changes in the separating equipment in combination with the above improvements.

This type of compressor utilizes the rotary principle to compress the air needed in air brake systems. Four overlapping compressions occur during each revolution of the compressor rotor which produce, at running speed, many thousands of air-impulses per minute.

Hydraulic Valve with Floating Piston

The new Gerotor 4-way hydraulic valve now in production at Gerotor May Corp., Logansport, Ind., has a "floating piston" design that permits close fitting of the piston in the valve bore and gives maximum sealing ability. The valve stem is supported in its bearings in the valve covers without any influence on the piston fit in the valve body.

Minimum leakage is gained not only from this close fit of the hardened and precision ground piston with the valve bore, but also from an "O" ring seal



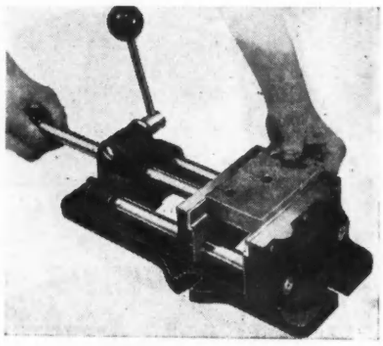
Gerotor 4-way hydraulic valve

design which prevents exhaust oil from leaking past the piston stem. Likewise an "O" ring seal on the valve covers assures positive sealing with no gasket.

Gerotor 4-way hydraulic valves are suitable for oil service with pressure up to 1500 psi, and can be furnished for 2500 to 3000 psi oil service. For high pressure water service, valves can be supplied with non-corrosive materials.

New Screwless Vise

National Machine Tool Co., Racine, Wis., has designed a screwless vise named the Grip-Master. Instead of an adjusting screw the Heinrich Grip-Master has a movable jaw which can be adjusted to the work and then locked securely by pressing on a locking lever. The bars and locking mechanism are hardened, then precision ground. The wide clearance between jaw guides per-



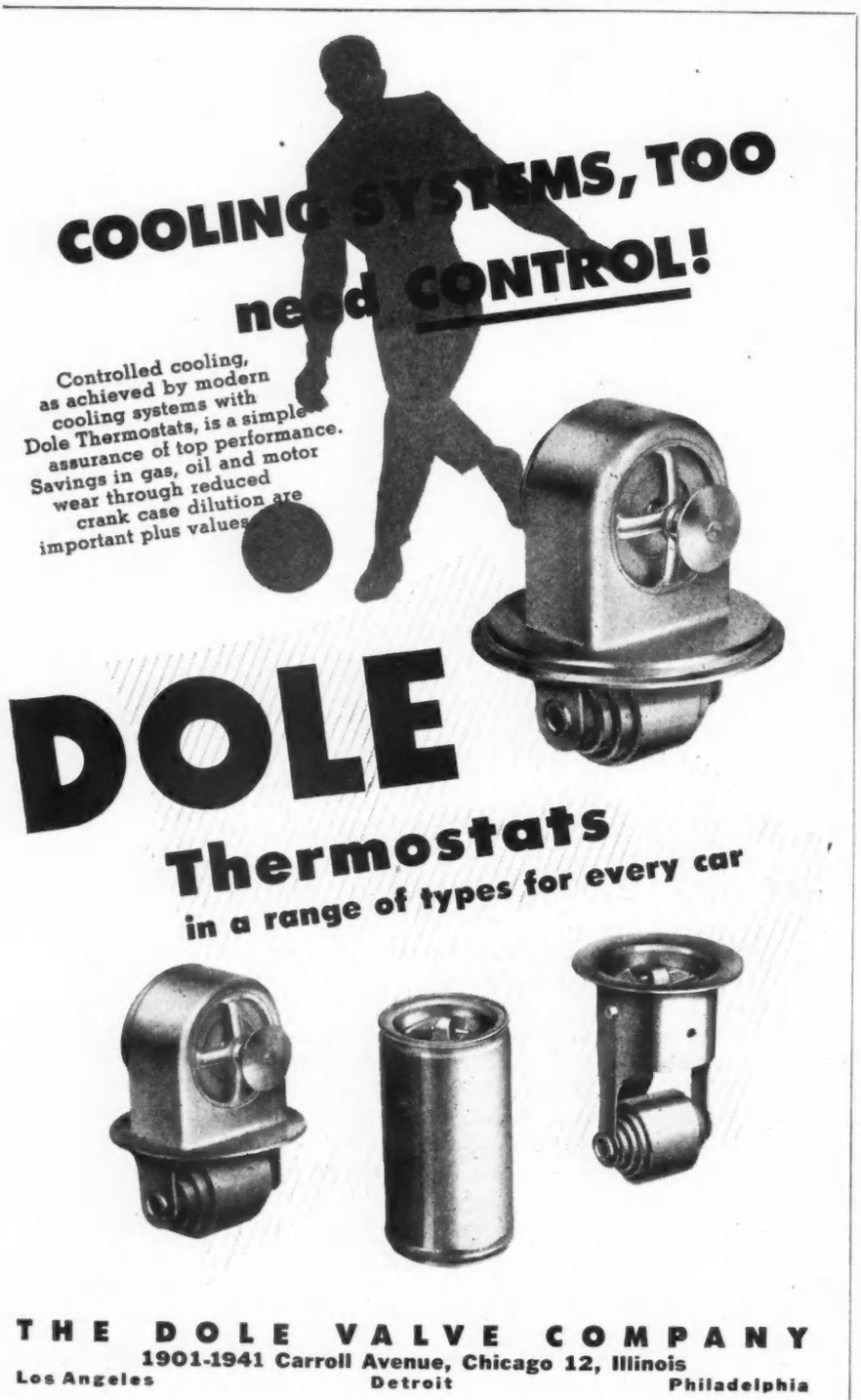
Grip-master vise

mits drilling right through the work and prevents interference from accumulating chips. Jaws have built-in, recessed parallels. A removable V-jaw accessory makes the drilling of round pieces easy. The Grip-Master comes in four jaw-widths, 3 in., 4 in., 6 in., and 8 in.

Magnetic Hardness Tester For Small Ferrous Parts

A magnetic hardness tester for rapid, accurate gaging of hardness of small, ferrous metal parts has been originated by General Electric's Meter and Instrument Division, West Lynn,

(*Turn to page* 91, *please*)


COOLING SYSTEMS, TOO
need CONTROL!
Controlled cooling, as achieved by modern cooling systems with Dole Thermostats, is a simple assurance of top performance. Savings in gas, oil and motor wear through reduced crank case dilution are important plus values.
DOLE
Thermostats
in a range of types for every car
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Detroit
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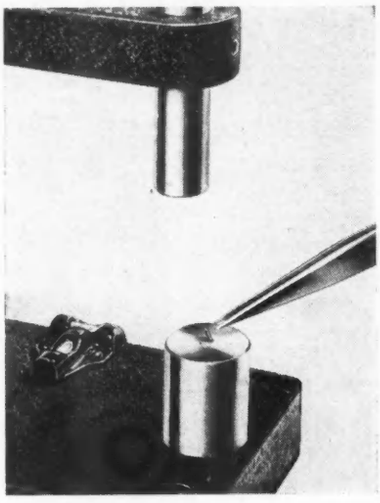
Mass. Providing a convenient "go—no go" hardness gage, this tester simplifies inspection of such parts as electric-instrument pivots and shafts, small steel balls, and other parts too small to be production-tested with mechanical-type hardness testers. It also permits spot checking of hardness in large sheets, or lengths of steel wire, through the comparison of random-selected small samples.

The tester, 6 in. long, 3½ in. wide, and 7 in. high, consists of an alnico bar magnet set in an adjustable, soft-iron frame, which permits the air gap, and thereby the field strength, to be set at the correct value for testing pieces of different size, whose dimensions are between 1/16 and ½ in. A knurled thumbscrew locks the air gap adjustment, and a brass block for positioning the specimens is mounted on the base of the tester, a little out of the direct line of the magnetic field.



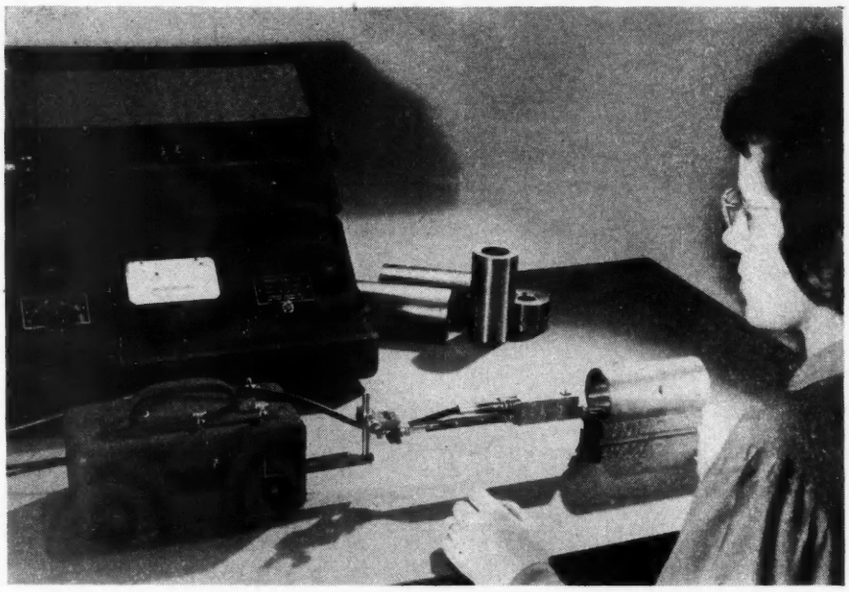
G-E magnetic hardness tester

The operation of the magnetic hardness tester is based upon the correlation of hardness and coercive force in magnetic materials. It checks pieces of unknown hardness against a specimen of known hardness by comparing, in a mechanical test, the relative strength of the magnetism produced in the test pieces and in the standard specimen under the same conditions of magnetization. This test is said to distinguish differences as little as two points on the Rockwell "C" scale, and does not damage the piece tested.

Dumping Attachment for Hydraulic Fork Trucks

The engineering department of the Mercury Manufacturing Co., Chicago, Ill., is releasing information on an attachment for Mercury hydraulic fork trucks which makes it possible for the operator of the truck to automatically dump the contents of

(*Turn to page 92, please*)



Postwar Improvements Must Go More Than Skin-Deep!

The American public is going to expect wonderful things from American industry now that the war is over. These expectations go more than skin deep. Inside modern, "stream-lined" cases and cabinets must be greatly improved motors and mechanisms, home appliances will have to run quieter—wear longer—and require a minimum of repair and service.

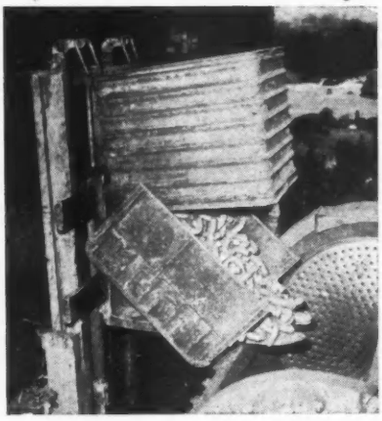
Meeting these performance requirements involves careful control of surface finish. The surface roughness of a machined part affects its appearance, its resistance to wear, its fatigue strength, its fit with other parts, and in many other ways.

The use of Profilometer equipment provides the most efficient and accurate method of controlling surface roughness. A staff of Profilometer Field Engineers is available to talk with you concerning the surface-finish control work in your plant. Our Field Engineer will call on you at your convenience and without obligation. Profilometer Catalog on request.

Illustrated above—Profilometer setup for production measurement of roughness on sleeve-bearings and other inside-diameter parts.

Profilometer is the registered trade-mark indicating Physicists Research Company's brand of surface-roughness gaging instrument.

PHYSICISTS RESEARCH COMPANY
343 SOUTH MAIN STREET · ANN ARBOR, MICHIGAN



a box skid while the load is in a raised position.

The box skids used are of a special hinged bottom design. Loops welded to the box are engaged by hooks on top of movable uprights of truck and cause bottom of box to fall away when forks are lowered. Attachments welded to the uprights of the trucks enable the operator to trip the load at pre-determined heights.

Mercury dumping attachment

Standardized Cone Drives

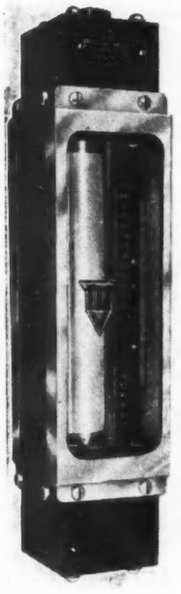
The Cone Drive Division, Michigan Tool Co., Detroit, will carry in stock Cone-Drive gear sets in 99 sizes and ratios. These have been developed to facilitate the selection of sizes and ratios best suited to each specific power transmission requirement.

Each of the sizes and ratios is rated as to horsepower for speeds ranging from 100 to 2400 rpm for each of five classes of service.

Safety-Shielded Rotameters

The Brooks Rotameter Co., Lansdale, ..., presents a new line of full-view ...tameters with "safety shielding" for ...ccurate flow measurement and control. The design is based on simple square lock end fittings, fastened together rigidly by heavy flat side plates.

"Safety shielding" is obtained by



Brooks rotameter

front and back safety glass windows, ¼ in. thick, held in place by stainless steel window frames, 3/32 in. thick. All surfaces are gasketed to prevent leakage.

These meters are available in sizes from ⅛ in. to 4 in. with screwed or flanged connections. With a metal tapered tube, they can be used for pressures as high as 600 psi.

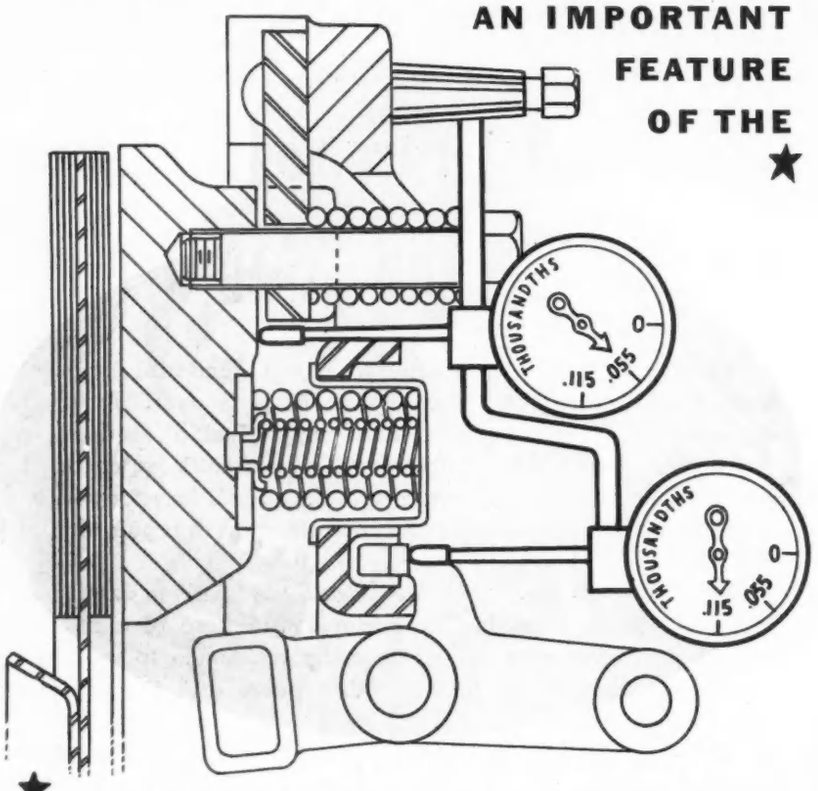
The full-view meter can be obtained as a simple flow rate indicator or with remote instrument for recording or recording - controlling - flow rate. Flow totalization can also be included.

Dow Chemical Co. Extends Washington Office Territory

Extension of the area of the Washington sales office of the Dow Chemical Co. to include Virginia, North and South Carolina, Georgia and Florida became effective Jan. 1, and the Washington staff is being augmented to handle the additional activity.

ENGINEERED *WEAR COMPENSATION*

AN IMPORTANT FEATURE OF THE ★



★

AUBURN CONSTANT PRESSURE CLUTCH

The unique design of Auburn Constant Pressure Clutches provides a specific, accurate amount of WEAR COMPENSATION predetermined to an engineered exactness . . . a patented feature, exclusive with Auburn.

OVER A MILLION AUBURN CLUTCHES IN SERVICE

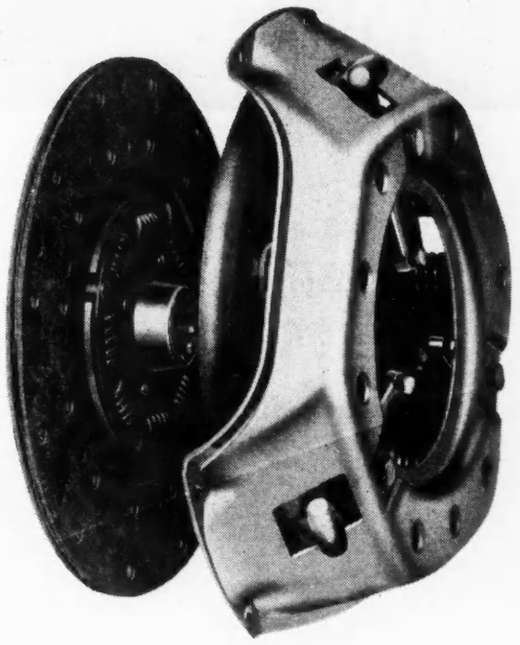
AUBURN MANUFACTURING COMPANY

DIVISION OF ATWOOD VACUUM MACHINE COMPANY

AUBURN, INDIANA, U. S. A.

You'd start like this

—if it weren't for SPRINGS!



Muehlhausen Springs are used in Long Clutches to transmit power with "creamy" smoothness.

Smooth, easy starting is taken for granted by the average motorist. But we seldom realize that each time we stop-and-go or change a gear, clutch springs must transmit and cushion a surge of engine power.

This cushioning action is accomplished in the Long Clutch by means of Muehlhausen Damper Springs, which transmit engine power from the driven disc to the splined hub flange.

Another set of Muehlhausen Springs is in the pressure plate assembly. These springs hold the pressure plate squarely and uniformly against the driving plate—and do this while withstanding scorching engine heat.

MUEHLHAUSEN SPRING CORPORATION
(Division of Standard Steel Spring Company)
650 Michigan Avenue, Logansport, Indiana

***To improve product performance, use* MUEHLHAUSEN Designed SPRINGS**

This·· or THIS

MOVES TONNAGE

By using narrow aisles—Moving many items at one time—Working 24 hours per day—Tiering materials to ceiling height—Increasing the productive efforts of labor —THE CLARK METHOD makes profit.

Rehandling is easy when THE CLARK
OD is used—THINK IT OVER.

K
actor
EK, MICHIGAN

ECTRIC STEEL CASTINGS
USINGS • BLIND RIVETS
PEED DRILLS AND REAMERS
GINGS • RAILWAY TRUCKS

Gregoire Car

(*Continued from page* 27)

also the steering gear and the power-plant. This cradle is attached to the forward bulkhead by eight studs.

The brake drums are a light alloy casting, incorporating a five-arm spider, with an iron liner set into the casting. Detachable rims in APM metal are bolted to the five spokes. The body panels are made of aluminum, with a close fitting stretched canvas for the top of the body. Renfrew Foundries, Ltd., owned jointly by Almin, Ltd., and Rolls-Royce, Ltd., will supply the aluminum alloy castings for the British model.

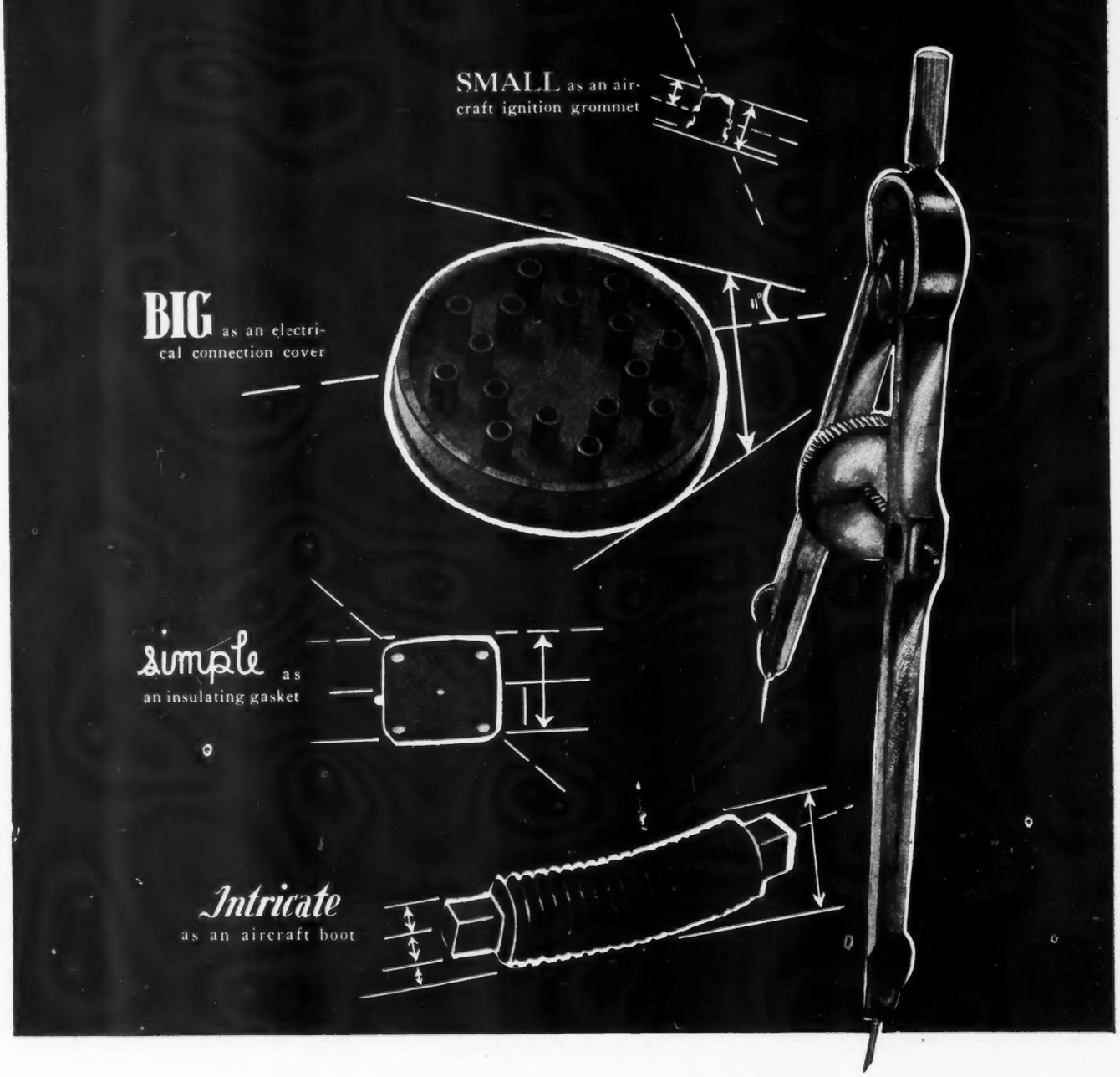
One of the features of the car is the adoption of a coil spring type of rear suspension. The coil springs are housed within the tubular crossmember between the frame side rails. Whether the car has only the driver aboard, or the full number of passengers with baggage, the riding, it is claimed, is excellent. On the first cars built to the Gregoire designs, torsion bars were used, but it is maintained the coil spring design now used costs less and is much more efficient.

Lockheed hydraulic brakes are used in front and Bendix mechanical brakes in the rear. There is a differential between the front and rear brakes, a safety device being provided whereby either will operate independently should one of the two sets fail.

The horizontally-opposed two-cylinder air-cooled engine has a 72 mm by 73 mm bore and stroke, the total piston displacement being 595 cc. Its maximum speed is 4000 rpm, at which it develops 15 hp. The cylinders are aluminum castings with nitrided iron liners and are bolted to the aluminum alloy crankcase. Detachable aluminum heads carry the valves. The cylinders are staggered on the crankcase, so that there is a two-throw crankshaft. Connecting rods are duralumin forgings and the pistons are machined from aluminum alloy castings. The push rods to the enclosed rocker arms are also duralumin. The generator and the starting motor are mounted on the top of the crankcase, as are the coil and distributor. Cooling is assisted by two four-bladed belt-driven fans, directing air through a cowling onto the cylinder barrels. For all normal running it is claimed that the fans are not necessary, and a clutch is inserted by means of which they can be put out of action by a control at the steering wheel. The carburetor is mounted at the rear of the clutch housing and is heated from one of the cylinders only.

Although a front-wheel drive, the clutch and transmission are behind the engine, the drive being carried through to the four-speed transmission, then forward to the universal jointed shaft. Fourth speed is 28 per cent higher than third, which is 1 to 1 ratio.

IF IT'S TO BE...


SMALL as an aircraft ignition grommet
BIG as an electrical connection cover
simple as an insulating gasket
Intricate as an aircraft boot

"If it's rubber--
it's H.O. Canfield"

If your new product calls for a rubber part—molded, die-cut, or extruded, made either to your blueprint specifications or from stock molds—wire or write.

FREE New H. O. Canfield General Catalog illustrates thousands of rubber and synthetic rubber parts

manufactured for the aviation, automotive, electrical, and general industries. Without charge, send for your copy today!

THE H.O. Canfield CO.
149 Housatonic Avenue Bridgeport 1, Connecticut

Chrysler Aircraft Engine

(*Continued from page* 25)

the propeller drive shaft, and rearward to the accessories train. Not only is this accomplished without transmitting torsional vibration into the elastic system but the torque reaction of the bull gear is taken out directly by the engine mounts on the crankcase at that point. It is worthy of note that the bull gear is possibly one of the most intensively loaded gears used in modern mechanism. It transmits a gross load of some 28000 hp with a face 2½ in. wide, a loading of 1120 hp per in. of face.

The reasons for the successful elimination of most torsional vibration in the complete engine system stems from the nature of the principal modes of crankshaft vibration. The complete system has a total of about 40 modes of vibration, all of which have been thoroughly investigated, but only four of which were found to be of any importance. Three of the four have little effect on the torsional characteristics of the system, either because they are not excited in the operating range or because they are excited only by the higher orders with concomitant amplitudes of very small magnitude. The remaining mode is the only one of major importance, but even it will permit safe operation up to 4000 rpm at 400 imep.

This latter mode affects none of the engine components except the crankshaft, because it has a node at the crankshaft drive pinion. Consequently, the camshaft, propeller shaft, and accessory drive shaft are not affected by vibration in this mode.

In addition to the isolation of other elements of the torsional system from the major crankshaft vibration, the long flexible shafts to the propeller and to the rear section provide a highly flexible cushion for other vibrations. As an illustration of this, the propeller torque variation is estimated to be less than two per cent of the mean torque throughout most of the operating range.

CYLINDER ASSEMBLY — Basic cylinder structure consists of 16 separable units—individual steel barrels securely fastened into the crankcase, and individual aluminum heads screwed onto the barrels with an interference fit. A feature of the barrels is the development of a single circular nut for securing them to the crankcase. Extension of the crankcase structure to the base of the cylinder head is another feature.

The cylinder head has two valves and two spark plugs, the limitation of openings contributing to greater strength without inhibiting breathing capacity. As a result of continuous refinements in stress conditions in the head, there have been no structural failures despite the fact that some heads have been run up to 80 hours at 400 IMEP.

Valve guides are of bronze. Valve seat inserts are of Wilcox-Rich Silcrome XBe, installed with shrink fit. Both intake and exhaust valves are sodium-cooled, the exhause valve having cooling for both the head and stem, while the intake valve has stem cooling only. Two concentric valve springs are used in each valve, interchangeable for both intake and exhaust. They are held in place laterally by guide rings located in a steel seat at the cylinder head and in a retainer at the opposite end.

Careful attention to piston rings has evolved the following setup:

No. 1 ring—plain compression ring, 1/16 by 0.151 in. radial wall, SAE 52100 steel, with chromium-plated face.

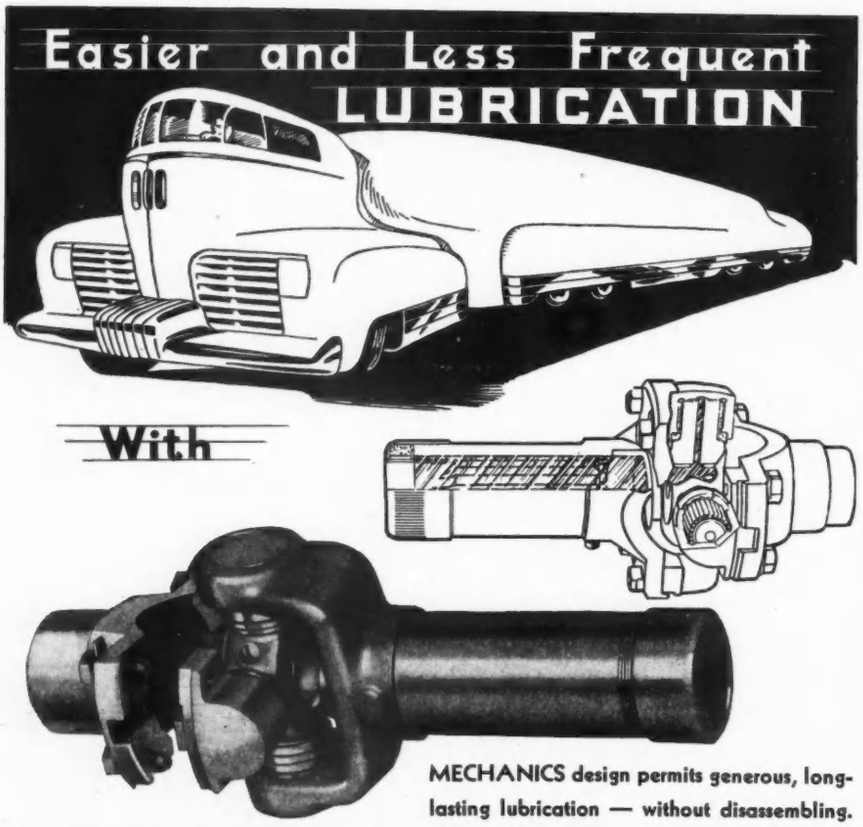
No. 2 & 3 ring—cast iron 1 deg taper face compression ring, 3/32 by 0.215 in. radial wall.

No. 4 & 5 ring—⅛ by 0.215 in. radial wall 20 deg beveled face oil scraper.

Four rings are located above the piston pins; the No. 5 ring is in the skirt. The piston pin is of carburized steel, nickel plated on the inside, and retained by two aluminum end plugs bearing on the cylinder wall.

CONNECTING RODS — Connecting rod assemblies are of fork-and-blade type with fork rod holding and locating the rod bearing by means of end

(*Turn to page* 98, *please*)



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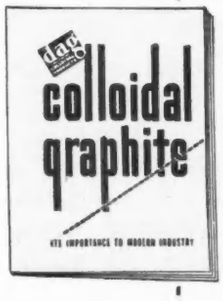

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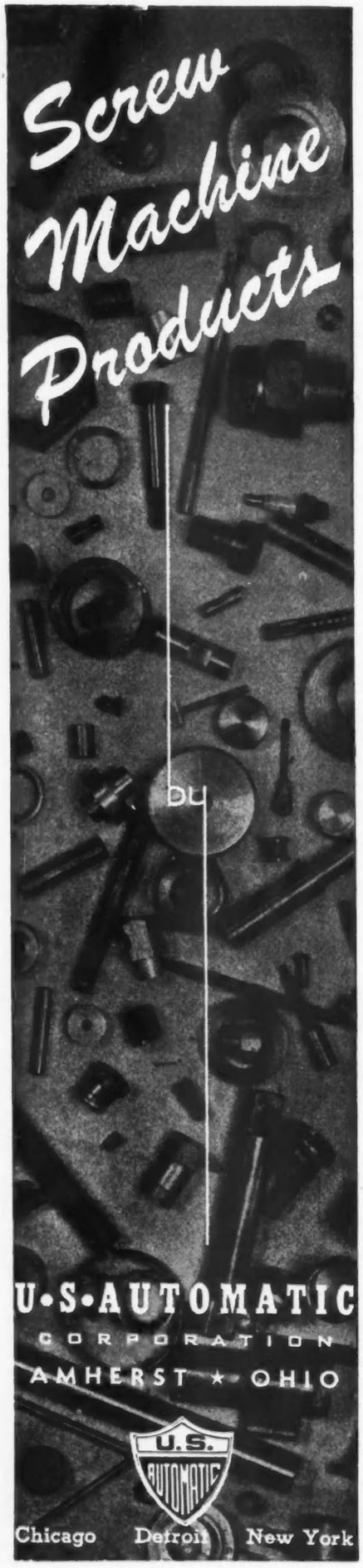

flanges, a circumferential press fit, and a dowell in one rod cap. Connecting rod bearings are of steel-back silver type with a lead-indium surface coating. Main bearings are of the same type.

CRANKCASE — For sand foundry practice the aluminum crankcase is an enormous casting and one which required considerable research not only as to the proper proportioning of sections but in foundry practice as well. It is a single piece casting some six feet in length and weighing about 500 lbs. It requires the pouring of 2000 lbs of aluminum alloy for its production. The case includes an integral high-pressure oil gallery, integral cylinder coolant jackets, and integral coolant outlet galleries. Main bearings are supported in a solid bulkhead wall, extending from the cylinder clamping flange to the top surface of the case. Bulkheads are bored to support the main bearings and are slotted to fit the main bearing caps. A self-aligning sleeve bearing having a spherical back is located between No. 1 and No. 2 cylinders to act as an intermediate support for the propeller shaft.

VALVE GEAR—Valves are operated by rocker arms from an "underhead" camshaft for each bank. Much like the crankshaft arrangement, the camshafts are made in two sections, bolted to the camshaft gear, and driven from a train of spur gears. The camshafts are located axially by thrust bearings and camshaft thrust flanges. Rocker arm shafts are supported by the camshaft bearing caps. Intake and exhaust rocker arms are identical and are supported on the rocker arm shafts. Tension surfaces of rocker arms are polished.

The valve end of the rocker arm incorporates a conventional tappet screw with ball and socket joint. The cam follower of the rocker arm assembly is one of the details which required considerable research before the final design was adopted. It consists of a 1⅛ in. diameter carburized steel roller having a crown of 24 in. radius. The inside bearing surface is silver-plated and runs on a hardened steel journal.

The valve gear system also contains four scavenging oil pumps, one in each end of the camshaft housings. They are driven by spur gears from the ends of the camshafts. Outlets of the two pumps in each housing are connected to a common return line which passes out through the camshaft housing cover.

SUPERCHARGER AND ACCESSORY SECTION—The main supercharger, integrally mounted within the engine proper, is of single-stage type developed by Chrysler. The installation includes an aftercooler mounted under the engine frame between the supercharger outlet and the intake manifold.

The supercharger and accessory section is an assembly composed of three main castings and their component

(*Turn to page* 100, *please*)

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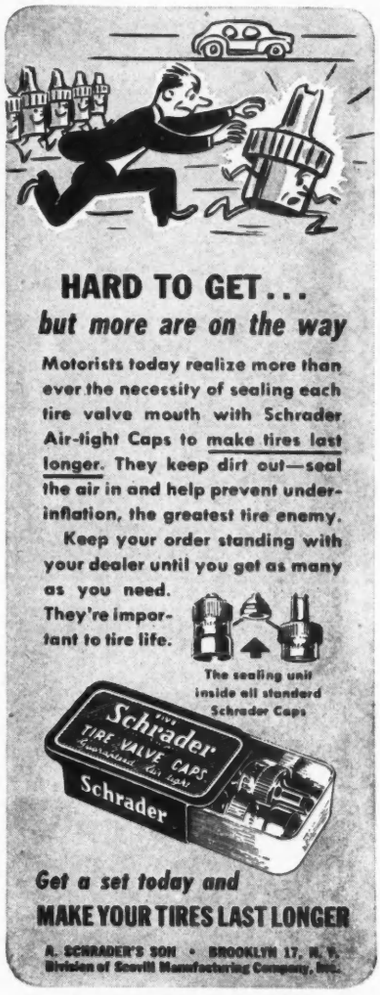
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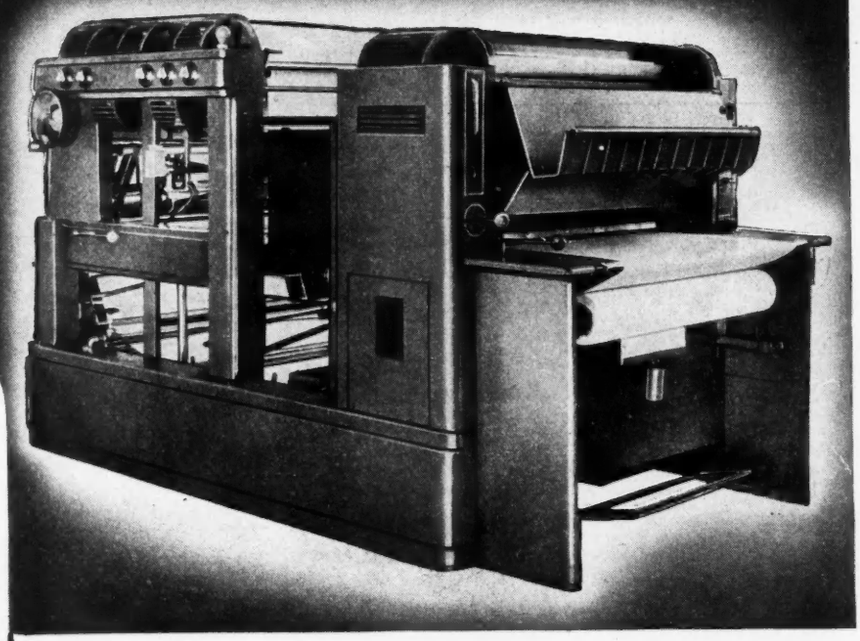

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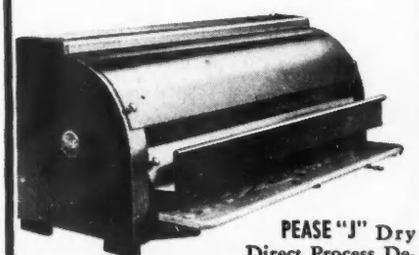

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parts. The supercharger air passage is divided between the supercharger front and rear housings. The front housing to which the diffuser plate is bolted also provides a mounting flange for the supercharger drive gear assembly. The rear housing provides the supercharger inlet elbow, main accessory drive shaft bearing, and mounting pads for the tachometer, and starter.

The principle of the "balanced drive" has been incorporated for the supercharger drive gears. With this design the load is divided evenly between two countershafts, which are driven by the main supercharger drive gear, the high speed impeller pinion being concentric with the main drive gear. Since the torque loads and separating loads on these two center gears are equal and opposite, the bearing load is zero. This symmetrical loading also prevents gear cocking.

To insure even division of load between the countershaft gears in the supercharger drive, a quill shaft is provided in each countershaft. This has the additional advantage of separating the gears from large attached masses, reducing the error loading on these gears. This arrangement obviates the complication in engines of a similar type where multiple telescoping quill shafts and the like are employed to obtain vibration isolation.

A starter shaft is splined into the rear of the crankshaft, and is supported at the outer end by a ball bearing in the rear supercharger housing. The tachometer shaft is driven from the starter shaft by a set of helical gears, and is supported by removable aluminum bearings.

INDUCTION SYSTEM — Principal elements of the induction system include the supercharger entrance, impeller, diffuser and scroll, and a center-feed manifold without double ported outlets and flame arresters. A Bendix pressure carburetor providing automatic density compensated mixture control is employed. From the carburetor the fuel mixture passes to the supercharger section, thence through the aftercooler into the intake manifold. The manifold is fabricated of cast aluminum and consists of three sections—two identical ends, and a center section which includes the inlet elbow. The mixture is fed from the manifold to the cylinders by means of eight "Y" shaped branches each of which serves two cylinders.

COOLANT SYSTEM — The coolant is circulated through the engine by a centrifugal pump mounted at the base of the accessory case. The quantity delivered is divided into two equal amounts by the pump volute and is discharged into two coolant manifolds, each supplying the coolant to one bank. Upon entering the cylinder head, the coolant first scrubs the hot metal surfaces below the center of the combustion chamber. It then flows around the intake and exhaust ports, through drilled passages, to an annular passage surrounding the barrel, and finally passes out into galleries of practically constant cross-sectional area cast into the crankcase and running its full length. Two outlets from each gallery are provided.

The coolant pump impeller is a cast, shrouded, backward-curved vane impeller, four inches in diameter. It is driven at 1.25 times crankshaft speed through a set of bevel gears, one of which is an integral part of the pump drive shaft. Two splash-lubricated ball bearings are used in the pump, the outer bearing (adjacent to the drive gear) also absorbing the end thrust applied by both the bevel drive gear and the impeller. Coolant is prevented from leaking around the pump shaft by a spring-loaded rubber bellows, which holds a stationary Morganite seal against a rotating steel washer mounted in the pump shaft. The pump has a capacity of 330 gpm against a 24 psi head at 4000 rpm (minimum inlet pressure 15 in. Hg Abs when pumping AN-E-2 ethylene glycol).

LUBRICATION SYSTEM — The oil pressure pump is of the gear type, the teeth having a slight helix. All gear journals run directly in the aluminum housing. The slide type pressure regulating valve returns oil directly from the pressure side of the pump to the

(*Turn to page* 102, *please*)

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Photos courtesy Douglas Aircraft Co., Inc., and Pratt & Whitney Aircraft

HYCAR helps keep Double Wasps humming

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EVERY possible precaution is taken to prevent anything going wrong with the fuel feed valves on the 2100 HP Pratt & Whitney Double Wasp engines that power the Douglas DC6 Skymaster. That's why resilient seals made from HYCAR are used in this sturdy but delicately adjusted mechanism that feeds gasoline to the supercharger throat, where it is mixed with air and fed to 14 cylinders.

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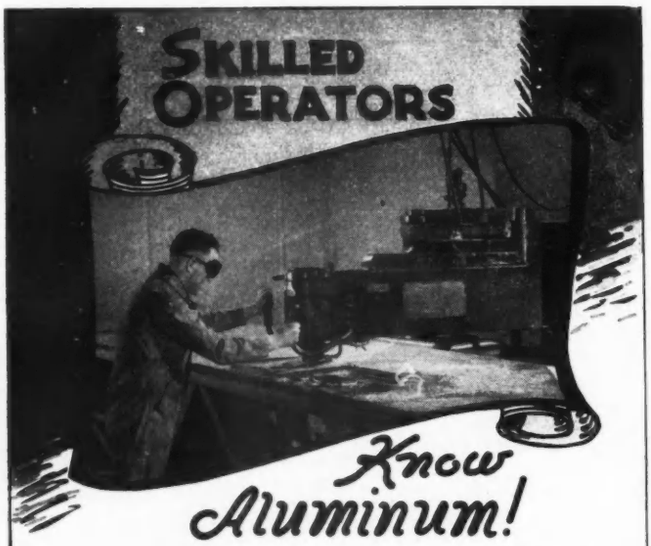

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inlet. It is controlled by the pressure after the filter and regulated by adjusting a compression spring. The "Air Maze" full flow filter is of bronze mesh, having a 0.0035 in. hole size. Poppet type filter by-pass and check valves are provided.

The oil pressure pump and filter and the pressure regulating filter by-pass, and check valves are located in an assembly bolted to the back of the accessory gear case in the lower right corner. The oil passes from the assembly into the accessory gear case and through an internal tube in the supercharger rear housing to the main oil gallery on the left side of the crankcase. From the main passage, maintained at a pressure of 65 psig, oil is supplied to the engine parts in the following manner:

Accessory Section Bearings are fed through a pressure reducing valve supplying oil at approximately 30 psig. This valve is located in the lower right side of the accessory gear case adjacent to the oil pressure pump assembly mounting pad.

Supercharger and supercharger drive gear bearings are fed at full pressure. Each main bearing is fed at full gallery pressure through a drilled line from the main crankcase gallery. Connecting rod bearings—Nos. 2, 4, 7, and 9 main journal lightening holes and all crankpin lightening holes are plugged. Oil is fed from the main journal lightening holes to both adjacent crankpin lightening holes through oil tubes which also serve as dowels to locate the plugs.

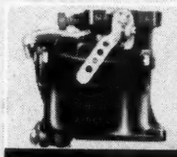
Oil is fed into the teeth of the main reduction gears as they enter mesh by two 0.062 in. diameter jets, one on each side. These jets are tapped into passages leading to the reduction gear bearings. The valve gear is supplied by a pressure reducing valve located in the side of the crankcase beneath the left engine mounting pad and drawing oil from the main crankcase gallery. Reduction gear bearings are fed by drilled passages from the two center main bearing supply lines. Propeller shaft transfer bearing is fed through a tube from the No. 9 main bearing.

Engine Front Cover bearings—Drilled passages supply both magneto bearings with oil at gallery pressure. Another passage opens into an oil reservoir located between the propeller governor shaft bearings, the reservoir oil pressure being controlled at approximately 10 psi by a multiple series orifice.

Production of Vehicles In Great Britain

Production of private cars in Great Britain is improving. The five principal makers had turned out 6,812 cars between V-J Day and the end of November, but production is increasing month by month. The industry hopes its 1946 output will be: private cars 470,000; commercial vehicles 135,000; buses 12,000.

THE BIG 3



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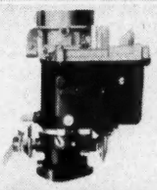

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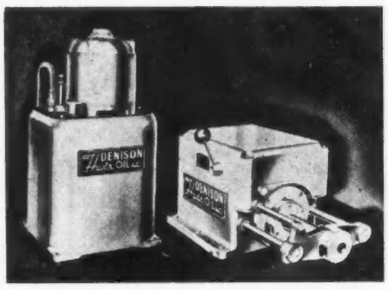
FOR EVERY PURPOSE

MARVEL-SCHEBLER CARBURETER DIV. BORG-WARNER CORP. FLINT 2, MICHIGAN

New Production Equipment

(*Continued from page* 50)

These individually "packaged" Multi-Unit press components include pumping units in two models and five models of power heads. All are designed for convenient mounting upon the user's machinery in positions where their unique pressing actions can be best utilized, or they can be mounted upon a standard Multi-Unit frame, which permits a variety of positioning arrangements of both pumping units and power heads.

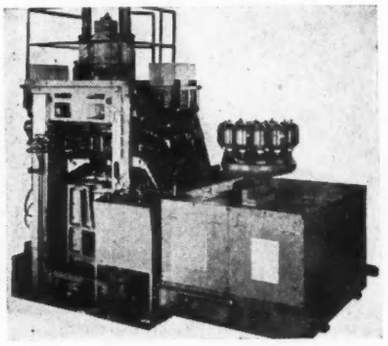


Denison hydraulic power assemblies

The pumping unit of those Multi-Units incorporates electric motor, hydraulic pump, pressure regulating valve, reservoir for the hydraulic fluid, and oil level gauge. It is available in 4 and 6-ton capacities, both having the same dimensional specifications, and may be located anywhere adjacent to the user's hydraulically-powered machine which it will serve, or to the Multi-Unit power head.

THE Taylor-Winfield Corp. plant at Warren, Ohio, has just completed two of the largest vertical flash welders ever built, one for General Electric Co. and one for Westinghouse Electric Corp.

This machine, hydraulically operated, is a vertical flash-butt welder, designed to join solid steel shafts to the turbine



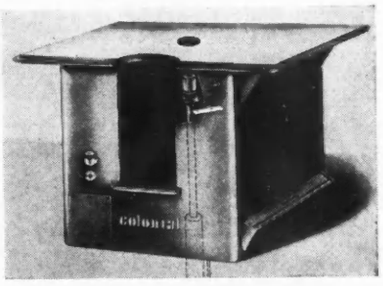
Taylor-Winfield vertical flash welder

bucket wheels of jet propulsion engines. As an indication of its size, it is equipped to take shafts from 1 in. to 6 in. in diameter, 12 to 72 in. in length and bucket wheel diameters of 5 to 40 in. The joining of similar pieces for other purposes can be made possible on these machines by slight changes in fixture design.

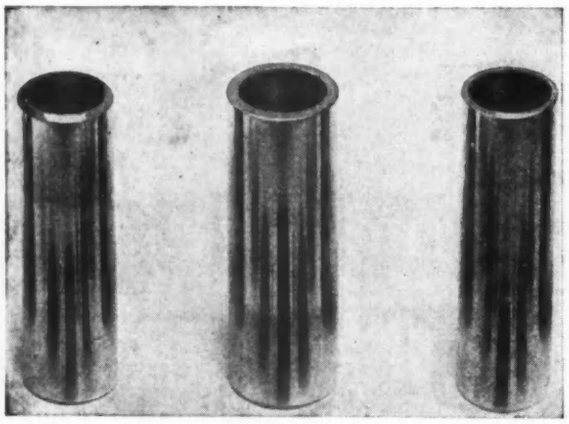
COLONIAL BROACH Co., Detroit, Mich., has just brought out a new line of broaching machines designated as the Colonial "Flat-top" Utility pull-down type vertical "horizontal" machines.

The machine is not intended for high production broaching, although automatic broach pullers are available. Its primary purpose is to fill the need for a "utility" machine for large work to eliminate special work holding fixtures.

(*Turn to page* 106, *please*)



Colonial broaching machine



These are samples of precision parts (illustrated below) of ferrous and non-ferrous alloys that have been made by Bessemore. On each of them, the screw machine work was completed within ten and twenty-five seconds and .002" tolerances were maintained. The grinding work is held to .0001" (tenth).

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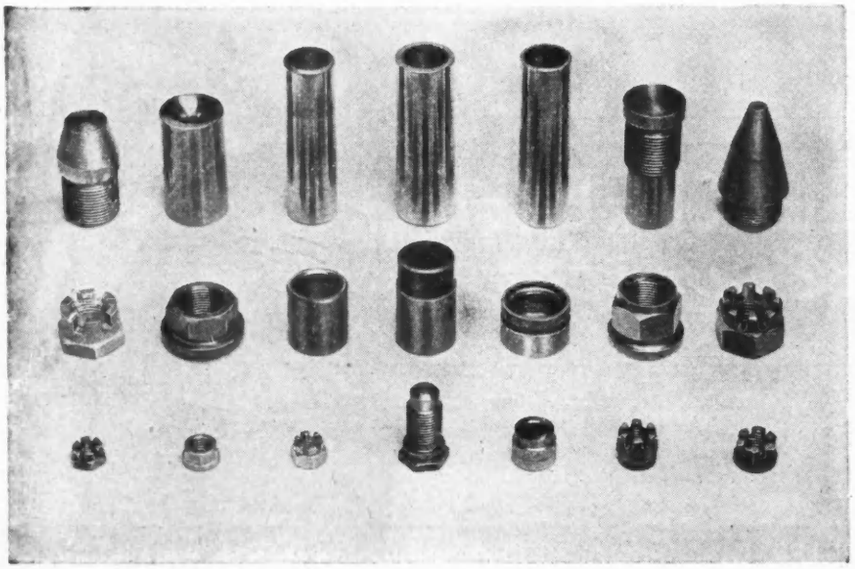
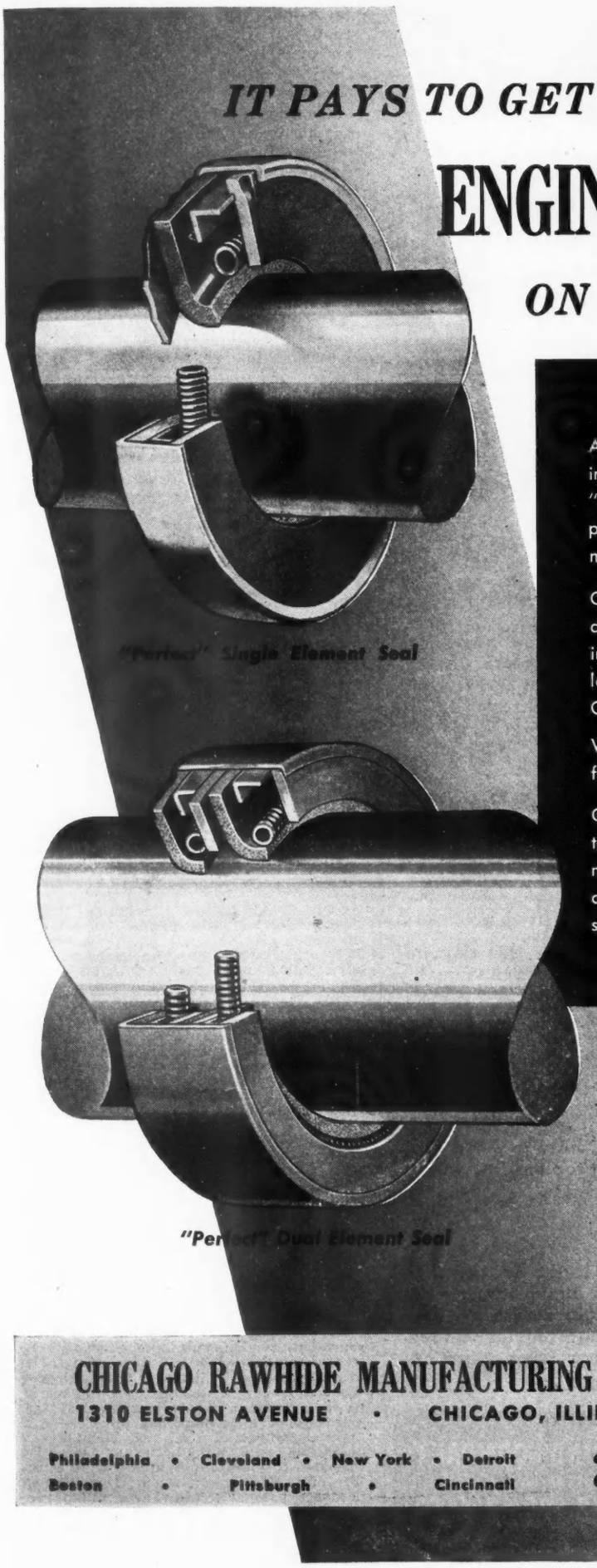


IT PAYS TO GET EXPERIENCED ENGINEERING ADVICE *ON SEALING PROBLEMS*



A transmission manufacturer in the design of an improved postwar power take-off, had selected a "Perfect" Dual Type Seal. He was willing to pay the price for this type unit in order to assure the maximum in sealing efficiency.

Chicago Rawhide Seal Engineers, after studying the drawings, recommended a minor change in the bearing housing and adjacent elements for the use of the less expensive, conventional single element "Perfect" Oil Seal.

When put on test, the desired improvement in performance had been achieved and at a reduced cost.

Chicago Rawhide Seal Engineers devote *all* their time to sealing problems. Their vast experience has aided many designers to achieve maximum sealing efficiency at minimum cost. Ask for their suggestions on your sealing problems.

CHICAGO RAWHIDE MANUFACTURING CO.
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66 Years Manufacturing Quality Mechanical Leather Goods Exclusively and now Sirvene Synthetic Products

In the "Flat-top," a broach is pulled through the work by an hydraulic pull-mechanism operating on the same principle as in Colonial Universal horizontal machines.

All operating mechanisms are concealed within the base. Provision is made for chip disposal through an opening in one side of the base. The machine illustrated is of 4-ton capacity with 30-in. stroke. It requires a floor area of only 42 by 65 in. The table measures 24 by 60 in. and its flat surface is 48 in. above the floor.

Aircraft Accumulators

(*Continued from page* 66)

precharge pressures. It is obvious that by doing so, the accumulator contains more fluid when fully charged and will maintain pressure on the system for a longer period of time when the pump is not operating. It is for this reason that these curves are plotted with air precharge pressures of 500 and 750 psi for a maximum system oil pressure of 1500 psi. One disadvantage of lower air precharge pressures, is the reduction of volumetric displacement within the pressure range controlled by the unloading valve or pressure regulator. In normal service, this requires the pump to cut in and out more frequently, which is a factor affecting the lift of the pump.

FOR BRAKE LINING . . .

Investigate **GRIZZLY**

Engineering

men will recognize the "know-how" resulting from 30 years of engineering development and research when they consult Grizzly.

Production

men will acknowledge that Grizzly plants employ the most modern mass production techniques, are adequately manned—ably managed.

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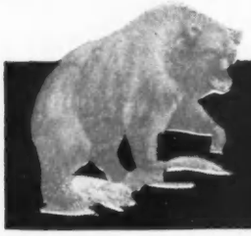
men will appreciate this dependable source of supply for fine quality molded brake lining in the competitive price range.

BIG . . . *but Flexible!*

True—Grizzly is big—but it has the necessary flexibility to serve each customer in the best possible way. Brake lining problems, of widely divergent natures, are solved at Grizzly.

EXPERIENCED . . . *but Alert!*

Thirty years experience in the manufacture of brake lining has provided Grizzly with a priceless background for making fine brake lining—has kept Grizzly constantly alert to new developments. Engineers are invited to the new brake lining engineering laboratory at Paulding—another achievement in Grizzly's alert, progressive operation.



GRIZZLY MANUFACTURING COMPANY
PAULDING, OHIO
PLANTS AT PAULDING AND LOS ANGELES
Warehouse Stocks in Principal Cities

American Airlines System Buys 100 New Planes

Jet exhaust propulsion will be used in commercial passenger airplanes for the first time as a result of the purchase of 100 new type planes by American Airlines System.

Jet propulsion, used on an auxiliary to conventional propeller drive, derives thrust from formerly wasted exhaust gas heat, and will increase the airplane's speed approximately 20 miles per hour.

The new twin-engine, 40-passenger Model 240 Consolidated Vultee aircraft will be used as supplements to American's Flagship Fleet of larger four-engine equipment. The 240 was designed to achieve the fastest and most economical service for flights of less than 1,000 miles in the United States, Mexico and Canada.

Advertising Note

F. L. Jacobs Co., has appointed MacManus, John and Adams, Inc., Detroit, as the advertising agency for its Major Appliance Division.

Classified Advertisements

ADDITIONAL LINES WANTED — Doring & Eyer Sales & Engineering Co., 404 Reliance Bldg., 216 East 10th St., Kansas City 6, Missouri. Kansas, Missouri, Nebraska and Iowa. Principal Lines: Automotive and Hardware.

Available—Top grade Designer and graduate engineer with experience on aircraft reciprocating and gas turbine power plants. Aircraft or automotive connection desired. Box 60, Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.

Belgian manufacturer and importer of automotive parts and accessories anxious to secure representation from American firms. Particularly interested in parts for standard American cars and trucks. Write: Slica, Ltd., 5 Place Genicot, Auderghem, Belgium.

MECHANICAL ENGINEER, M.I.T. '32, previous successful career interrupted by Naval Service, desires to establish own business as Philadelphia (or adjacent) area representative of manufacturer of automotive, machine tool or allied products. Has broad knowledge of industry and experience second to none in dealing with top executives, engineers and sales managers of large and small organizations, plus down-to-earth know how gained from establishing and operating own manufacturing enterprise. Prepared to operate individually or to establish first class organization depending on products, prospects, and your merchandising policy. Box 59, Automotive and Aviation Industries, 5601 Chestnut St., Philadelphia 39, Pa.